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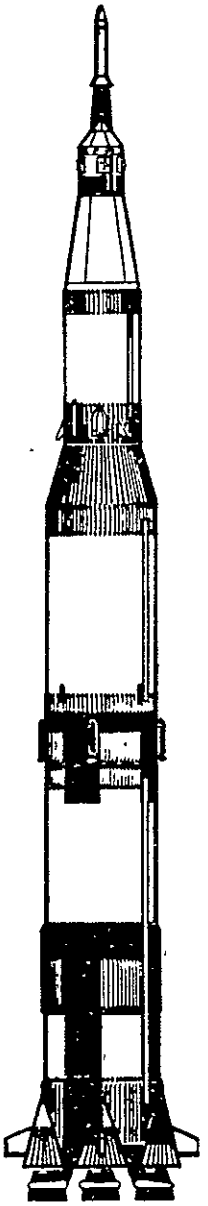

FINAL REPORT
FOR THE VIP'S ADDRESSABLE INTERFACE UNIT
MARCH 31, 1971

REPORT

HOUSTON, TEXAS

ELECTRICAL/ELECTRONICS

CR-114997

April 5, 1971
5-2934-HOU-290

To: D. R. Osgood NASA/MSC EB4

cc: O. Patterson NASA/MSC EB4

Subject: Final Report on GRE Modifications

The following is The Boeing Company's final report on Contract NAS9-9347 for the period from April 1, 1970 through March 31, 1971. The work accomplished for each task is summarized in the following. Detailed reports were submitted where noted.

TASK A

Technical recommendations were made on NASA's modifications to enable one GRE to process earth resources infra-red data. Assistance was given in the initial start-up of the GRE by operating and adjusting the GRE's original functions and by determining and recommending the changes required to make the newly installed modifications compatible.

TASK B

An investigation of the GRE's resolution capabilities was conducted in April, 1970, by making a film run containing horizontal and vertical lines of various widths and by reviewing developmental data compiled at the time of original manufacture. The processed film was submitted to Mr. D. Osgood, NASA, and reviewed data is summarized again in the following:

1) Resolution

When using an 800 Hz line rate, the highest frequency sine wave having the full black-to-white film densities that the GRE's will reproduce, is one that results in 20 line-pairs per mm. The total horizontal resolution across the film width then is 480 line pairs or 960 television lines. Sine waves to 40 line pairs per mm are discernable but are degraded by the film grain which at this spatial frequency is 12 to 16 grain widths per sine wave cycle.

2) Linearity

A linearity of 0.05% was measured from a crosshatch pattern in both the horizontal and vertical axes.

3) Noise

No noise is visibly added by the GRE under 30X magnification except that caused by phosphor impurities in the kinescope.

Because the requirement for the capability to process high resolution lunar survey data did not materialize, the capability for processing data from a computer or core memories has not been extended in GRE #1 beyond the three formats of 320, 525 and 1280 lines per frame at a line rate of 800 Hz.

TASK C

An addressable interface was designed, installed and tested in GRE 1. The interface provides the necessary logic circuitry to permit control and monitoring of GRE functions by a digital computer. The hardware produced consisted of interface circuits installed in GRE 1 and two cards of digital logic circuits, one for the GRE and one for the IBM 2701 interface.

In developing the GRE interface, a generalized addressable interface was developed which is extendable to all of the computer and peripheral equipment in the Visual Information Processing System. Specifically, the concepts developed were the command and data bus format, the line driver/receiver party line interconnection of the interface cards, the power distribution and grounding plan, and the initial layout of the packaging cards and the card file chassis.

A detailed report of the addressable interface developed is attached.

TASK D

An analog image enhancement device was designed and developed to improve the sharpness of the Apollo 11 television data which was degraded primarily by the television system's limited bandwidth. The device developed detected edge contours in a scene and synthesized a corrective waveform which was added back into the lower frequency video to make the edges appear sharp. The primary task was developing an edge detector which would find the proper amplitude and polarity of the edges and yet discriminate against noise.

Approximately 40 minutes of data was reconstructed into motion picture format using this analog enhancement device. The detail report completing the task was submitted August 27, 1970 as Report No. 5-2934-HOU-264. Because of the high probability that the Apollo 11 ten-frame-per-second format would not be used on future missions, it was decided by mutual agreement not to make a permanent installation of the analog enhancement device in any of the GRE's.

Prepared by: Dale O. Haakenson
D. J. Haakenson

Approved by: W. L. Neale
W. L. Neale

DETAILED REPORT ON TASK C

"THE ADDRESSABLE INTERFACE UNIT"

Prepared Under Contract
NAS9-9347

March 31, 1971

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W. L. Neale

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1.0 OPERATIONAL DESCRIPTION

1.1 GENERAL

The Command and Data Bus was developed to be part of the Visual Information Processing System (VIPS). The Command and Data Bus is an addressable interface allowing a demand-response, bidirectional transfer of commands and data between the digital computers and their peripheral equipment. The command and data portions of the interface bus were designed such that their utilization may be simultaneous. This is possible because each bus has its own control lines. The intended operational mode is for computer control items and the data transfer modes to be set up by the command bus and only data for digital processing be transferred on the data bus.

The transmitter's use of the command bus is initiated by raising the Command Select and Command Ready control lines. The Command Ready is not raised until the command and parity bits are valid. The receiver acknowledges by returning a 1 μs Command Acknowledge. The command sequence is terminated by the transmitter sending a Command Transfer Finished upon which the receiver returns a 1 μs End of Record. A similar sequence of events takes place for the transfer of data on the data bus. The counterpart data bus functions are Data Select, Data Ready, Data, Data Parity, Data Acknowledge, Data Transfer Finished, and Data End of Record. The system timing diagrams are shown in Figure 4.

An error detection scheme was designed which detects errors in data or command parity and impossible command or data modes of operation. The particular error modes which will be detected are: commanding a device to receive data when the data bus is already busy and commanding a device to transmit when the data bus is busy.

The system responses for the later two errors are that the transmitter raises the Command Error in the first case and the receiver raises the Command Error in the second case. Errors in parity, when detected, are reported by the receiver, raising the respective Command Parity Error or Data Parity Error.

1.2 IBM 2701 INTERFACE CARD

1.2.1 Correlation of the IBM 2701 data-out functions with the VIPS Command Bus bit position is as follows:

IBM 2701	VIPS COMMAND BUS
Data Out 1	Address Bit 0
" 2	" 1
" 3	" 2
" 4	" 3
" 5	" 4
" 6	Command Bit 0
" 7	" 1
" 8	" 2
" 9	" 3
" 10	" 4
" 11	" 5
" 12	" 6
" 13	" 7
" 14	" 8
" 15	" 9
" 16	" 10

1.2.2 Correlation of the IBM 2701 data-out functions with the VIPS Data Bus bit positions is as follows:

IBM 2701	VIPS DATA BUS
Data Out 1	Data Bit 0
" 2	" 1
" 3	" 2
" 4	" 3
" 5	" 4
" 6	" 5
" 7	" 6
" 8	" 7
" 9	" 8
" 10	" 9
" 11	" 10
" 12	" 11
" 13	" 12
" 14	" 13
" 15	" 14
" 16	" 15

1.2.3 Correlation of the IBM 2701 data-in functions (Read Mode) with the VIPS Data Bus bit positions is as follows:

IBM 2701	VIPS DATA BUS
Data In 1	Data Bit 0
" 2	" 1
" 3	" 2
" 4	" 3
" 5	" 4
" 6	" 5
" 7	" 6
" 8	" 7
" 9	" 8
" 10	" 9
" 11	" 10
" 12	" 11
" 13	" 12
" 14	" 13
" 15	" 14
" 16	" 15

1.2.4 Correlation of the VIPS address and command bit positions with the IBM 2701 Interface Card commandable functions are:

VIPS COMMAND BUS		IBM 2701 INTERFACE CARD
Address Bit	0	Address Bit 0
"	1	" 1
"	2	" 2
"	3	" 3
"	4	" 4
Command Bit	0	Enables 2701 to receive EOR's
"	1	Enables 2701 to receive EOF's
"	2	Enables 2701 to receive Interrupts
"	3	Enables IBM 360 External Interrupt No. 1
"	4	Enables IBM 360 External Interrupt No. 2
"	5	Enables IBM 360 External Interrupt No. 3
"	6	Enables IBM 360 External Interrupt No. 4
"	7	Enables IBM 360 External Interrupt No. 5
"	8	Spare
"	9	Spare
"	10	Spare

1.3 GRE Interface Card

1.3.1 Correlation of the VIPS Command Bus functions are as follows

VIPS COMMAND BUS		GRE INTERFACE CARD
Address Bit	0	Address Bit 0
"	1	" 1
"	2	" 2
"	3	" 3
"	4	" 4
Command Bit	0	"1" = Command GRE to transmit data
"	1	"1" = Command change
"	2	Spare Channel
"	3	Spare Channel
"	4	"1" = Command GRE Main Power On

VIPS COMMAND BUS	GRE INTERFACE CARD
Command Bit 5	"1" = Command Focus On
" 6	"1" = Command Anode On
" 7	"0" = Test Pattern, "1" = Input Video
" 8	"1" = Film Drive On
" 9	Spare
" 10	Spare

1.3.2 Correlation of the VIPS Data Bus bit positions with the monitored GRE functions are:

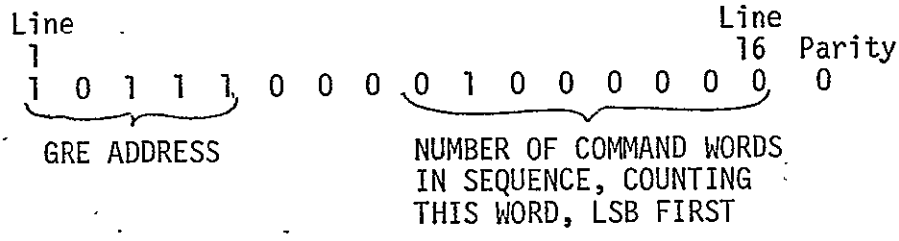
VIPS DATA BUS	MONITORED GRE FUNCTIONS
Data Bit 0	"1" = GRE Fault
" 1	"1" = Main Power On
" 2	"1" = Focus On
" 3	"1" = Anode On
" 4	"1" = Video Selected
" 5	"1" = Film Drive On
" 6	"1" = CRT Not Blanked
" 7	Spare
" 8	Spare
" 9	Spare
" 10	Spare
" 11	GRE Address Bit 0
" 12	" " 1
" 13	" " 2
" 14	" " 3
" 15	" " 4

1.4 Programming Considerations

1.4.1 The following example is given to aid computer programming through the IBM 2701 and VIPS Command and Data Bus interface. The programming sequence that may be used to initially turn on the GRE is as follows:

1. Raise Write Select

2. Data Out, Word 1:



3. Raise Write Ready

4. Look for Demand in response

5. Data Out, Word 2:

   0 0 0 0 0 0 1 0 0 1 1 1 0 0 0 0, Parity = 1

6. Raise Write Ready

7. Look for Demand in response

8. Raise WC=0 & Write Ready

9. Look for EOR in response

10. Lower the Write Select, WC=0, and Write Ready

The above sequence should have turned on the GRE Main Power, Focus, and Anode. For proper operation of the GRE, the previously furnished instructions still apply with respect to turn-on sequence, warm-up times and etc. The logic for the GRE Interface Card was designed to prevent an incorrect sequence of commands from resulting in damage to the equipment.

1.4.2 The following example will command the GRE to transmit one data status word through the 2701 interface:

1. Raise Write Select

2. Data Out, Word 1:

   1 0 1 1 1 0 0 0 0 1 0 0 0 0 0 0, Parity = 0

3. Raise Write Ready
4. Look for Demand in response
5. Data Out, Word 2:

   0 0 0 0 0 1 0 0 0 0 0 0 0 0 0 0, Parity = 0
6. Raise Write Ready
7. Look for Demand in response
8. Raise WC=0 and Write Ready
9. Look for EOR in response
10. Lower the Write Select, WC=0, and Write Ready
11. Raise Read Select
12. Raise Read Ready
13. Look for Demand
14. Read Data In
15. Lower Read Ready
16. Look for EOR
17. Lower Read Select

The data read should be the functions turned on in Section 1.4.1.

1.4.3 The error conditions may be interpreted as follows:

a) When no response is received to the initial Write Ready, it should be interpreted that the command bus was busy.

b) When a parity error is received during the transmission of commands, it should be interpreted that the receiving device has detected a command parity error unless the command is a command-to-receive data. In this case, the parity error indicates the 2701 card detected the Data Bus was busy.

c) When a parity error is received just after a peripheral device has been commanded to transmit data, it should be interpreted that that device detected the Data Bus busy.

d) When a parity error is received during a data transmitting mode, it should always be interpreted that the receiving device has detected an error in data parity.

2.0 PHYSICAL DESCRIPTION

2.1 Interface Cards

The logic for the interfaces was designed using TTL Integrated Circuits in 14 and 16 Pin Dual In-Line Packages, DIP's, and discrete components such as resistors, capacitors and diodes mounted on blank 14 and 16 pin DIP discrete component modules. The DIP's were packaged on Augat panels having 6 groups of 9 contact rows. The interconnecting wiring between the DIP's was wire-wrapped to the contact posts on the reverse side. Two 122 contact connector tabs were used for inputs and outputs. The connector for the command and data bus was located at the Group A end and the connector for the interfaced equipment (e.g., the IBM 2701 and GRE equipment) at the Group F end. The card pin functions used were those agreed upon at the February progress report meeting and are shown on the detailed logic diagrams. (See Figure 6)

The DIP's were arranged in 26 vertical rows with 0.1 μf miniature capacitors spaced in the pair of unused contacts between the ends of adjacent DIP's. A more compact arrangement, if needed, would be to arrange the DIP's in a checkerboard manner with the decoupling capacitors permanently wire wrapped to the contact posts on the reverse side.

This arrangement would allow an additional 24 DIP's to be placed on the board. The total board capacity would then be 204 DIP's of which 26 may be of 16 pin type and the remainder being the 14 pin type.

2.2 GRE Installation

The manual controls for the GRE functions commandable from the VIP's Command and Data Bus interface are located on a panel entitled, "Composite Control Panel" which is just below the oscilloscope in rack 1A1. A chassis was mounted to the rear of this panel which contains the relays and electronic components for the control and monitoring of GRE functions. One interconnecting cable is required between the VIP's interface and the GRE. The cable connects directly to the rear of the Composite Control Chassis and is accessable by opening the rear access door to 1A1.

2.3 Drawing List

2.3.1 IBM 2701 Interface

VIPS-021-01 Detailed Logic Drawing

VIPS-021-2 Logic Module Layout

VIPS-021-4 Detailed Wire Listing

VIPS-021-3 Integrated Circuit Listing

VIPS-021-5B Discrete Component Modules

VIPS-021-5C RC Timing Modules

VIPS-021-5D Resistor Modules for 2701 Drivers

2.3.2 GRE Interface --

VIPS-022-01 Detailed Logic Drawing

VIPS-022-2 Logic Module Layout

VIPS-022-4 Detailed Wire Listing

VIPS-022-3 Integrated Circuit Listing

VIPS-022-5B Discrete Component Modules

VIPS-022-5C Panel, GRE Composite Control

VIPS-022-5D RC Timing Modules

VIPS-022-5E Discrete Component Modules

3.0 ELECTRICAL

3.1 Power Distribution

A schematic of the power distribution recommended in a previous report is shown in Figure 1. Decoupling of each interface card with the power supply, ground, and other interface cards was provided by the input filtering. The inductor in the ground line blocked the high frequency components of chassis ground transients from disturbing the ground potential on each interface card. It was also recommended that returns be provided for all signals to peripheral equipment and that the laboratory and bus chassis ground not be used for signal returns. A schematic of the recommended laboratory grounding system is shown in Figure 2.

A number of 0.1 μf ceramic capacitors was recommended to be distributed on each interface card between the +Vcc, -Vcc and ground planes.

This will bypass the high frequency current components that are required by the rapid rise-times of TTL circuits and will provide better leading and trailing edges in the logic signals.

3.2 Power Consumption

The power consumption experienced for each interface card was as follows:

IBM 2701:	GRE:
+5 Volts - 3.9 amperes	+5 Volts - 2.7 amperes
-5 Volts - 0.68 ampere	-5 Volts - 0.40 ampere

3.3 Logic Circuits

Series SN74XX and SN75XX Transistor-Transistor Logic (TTL) integrated circuits were used exclusively in the design of the IBM 2701 and GRE interfaces. The TTL circuits were selected because of their immunity to noise, application simplicity, speed and availability of logic functions, registers, counters, multivibrators, etc. There was a large margin in the noise and speed capabilities of this logic which offers a good growth capability for system speed.

3.4 Command and Data Bus Circuits

A differential line driver/receiver circuit was used at the Command and Data Bus interface. A schematic of the bus interface previously recommended is shown in Figure 3. The line drivers were constant current source, differential output types such that the common mode return current through the system ground was a steady state value. The drivers have enable/disable gates which, when in the disabled state, have very large output impedances that do not load the bus when another driver

is enabled. The line drivers used have a 6 ma. current source that generated a difference voltage of 0.6 Volt across a 100 ohm line impedance when switching logical states. The line receivers used have differential inputs which provide a logical "0" or "1" output depending on the polarity of the signal lines. The receivers have a large input impedance so as to not load the bus structure even if a large number of receivers are used. The line receivers tended to have a noise output when that respective line pair was not driven. This receiver noise was inhibited by the enable gates. The data, command, and interrupt control functions will require appropriate consideration to inhibit receiver noise when these functions are not in use. It was recommended that the Line Termination Network, as shown in Figure 3, contain the matched and balanced transmission line terminations and noise inhibitive circuitry.

The primary advantage in using the differential line driver/receiver for this interface was noise immunity. If a balanced transmission line, such as a twisted pair is used, nearly all noise induced on the line will be common mode. Ground potential shifts as high as ±3 Volts will be allowed at any of the interfaced equipment and its corresponding interface card without undue effects as they will be a common mode. This will prevent data and control errors due to laboratory ground loops and allow each piece of equipment to be connected to the laboratory ground.

It is pointed out that the command and data bus structure designed offers a considerable growth capability in speed. It would require a minimum

modification to the bus structure to synchronously transfer data at rates greater than 10^7 bits per second in each of the parallel 16 bit positions of the Command and Data Busses.

3.5 Logic Description - IBM 2701 Interface Card

The IBM 2701 Interface Card transforms all of the IBM 2701 Write and Read functions into those compatible with the VIP's Command and Data Bus. The 16 Write lines from the IBM 2701 were further broken out into 16 command lines and 16 data lines. The sequence of events through this interface require four word types in the IBM 2701 Write mode. These word types are: (1) Introductory Word consisting of the address for the equipment to be selected and the number of command words; (2) Command words; (3) Data words; and (4) Dummy Write word with Word Count = 0. The logic on the IBM 2701 card operates in the following manner for the Write sequence: The Write Select will enable the 2701 card to receive the succeeding command providing the VIP's command bus is not already in use. If the command bus is busy, the 2701 card does not respond to the Write Select and Write Ready and allows the 2701 to "Time-Out." When the command bus is not busy, the address and number of commands to be transmitted portions of the initial word are loaded on latching registers Z34, Z36, Z39 and Z40. The succeeding command words then are transmitted and gated through to the command bus. Each command is counted on Z41 and Z42. When the count equals the number loaded on Z39 and Z40 during the first word, the next Write word from the 2701 will be transferred as data to the VIP's Data Bus through registers Z28, Z29, Z30 and Z31 along with the

Command Transfer Finish (CTF) to terminate the command sequence. If a Word Count equals 0 is also given from the 2701, the VIP's Data Bus is not enabled and only the CTF is put on the command bus. A D-type multivibrator, Z27-1, is used to store the command count when it is reached, and one is used to store the fall of the Command End of Record (CEOR), Z26-2.

The 2701 card has the capability of having the EOR, EOF, Interrupt and five additional functions enableable when addressed through the VIP's Command Bus. The address can be changed by interchanging the address module located at the top of Group C, Contact 1. Any five bit address may be used in this module. The address delivered with the card is 10110. All of the responses to commands from this section of the 2701 card are made to the VIP's Command Bus which are sensed by the card transmitting the command which may be the 2701 card.

Parity from the 2701 is checked with Z1 and Z2 and regenerated with Z3 and Z4 in the command transfer mode and passed through directly in the data transfer mode. When data is transferred from the VIP's Data Bus to the 2701, the parity is passed through directly also.

3.6 Logic Description - GRE Interface Card

The GRE Interface Card was designed such that it can be commanded to receive commands from the VIP's Command Bus or transmit a data status word on the VIP's Data Bus. The GRE's address is encoded on Z1, a 16 pin module, with an address of 10111. Z2 is an identical module encoded

with the same address for identifying the GRE when the data status word is transmitted on the Data Bus. Parity of received commands is checked by Z3 and Z4 and is generated for transmitted data by Z5 and Z6. When a command is received having the GRE's address and proper parity, it is loaded on register Z22, Z23 and Z24. A later phase of the clock will load respective command changes on multivibrators Z42, Z48, Z52, Z58 and Z63. The multivibrators have an alternate clear input from the VIP's Master Clear or from the GRE Clear on the GRE Composite Control Panel. In addition, each multivibrator is alternately controlled through its preset and clear functions in a 2-way switch arrangement between commands from the command bus and from switch functions on the Composite Control Panel. That is, each GRE function can be controlled by either a command from the Command Bus or by a manual switch input at the GRE.

The data transmitted from the GRE consists of one word of GRE address and status information followed by a time slot occupied by the Data Transfer Finished (DTF). The GRE functions reported in the status word are the Address, GRE Fault, Main Power, Focus, Anode, Video Select, Film Drive and CRT Blanking. The status information always appears at the input to the Data Register Z25, Z26, Z27 and Z28 and is clocked through to the VIP's Data Bus when commanded. The data transmit command is given by inserting a "Read" bit in the command word which is sensed by Z20. When Z20 is latched, the data transmit sequence begins by raising the Data Select and Data Ready lines and strobing the Data Register. When a Data Acknowledged is received, the Data Ready is lowered and the Data Transmit Finished (DTF) is raised by Z56A. The

receiver then returns the Data End of Record (DEOR) which resets the GRE's data transmit logic and lowers the Data Select.

An alternate mode of data transmission from the GRE Interface Card is initiated by the detection of a malfunction. The malfunction detection logic is enabled only when the GRE Recording Camera has been commanded on by the VIP's Command Bus. To report such a malfunction, Z34 "Ands" the Data Select with the output of the Malfunction Detector to clock Z21. An output is latched on Z21 if the VIP's End of File (EOF) function is not in-use. A 1 μs EOF pulse is given to interrupt the control computer enabled to receive the EOF. The Write mode then proceeds as if the GRE Interface Card had been commanded to Write. In the event an EOF was in use when the malfunction was first detected, Z21 will be reset with the fall of the Data EOR and is reclocked when the Data Select falls.

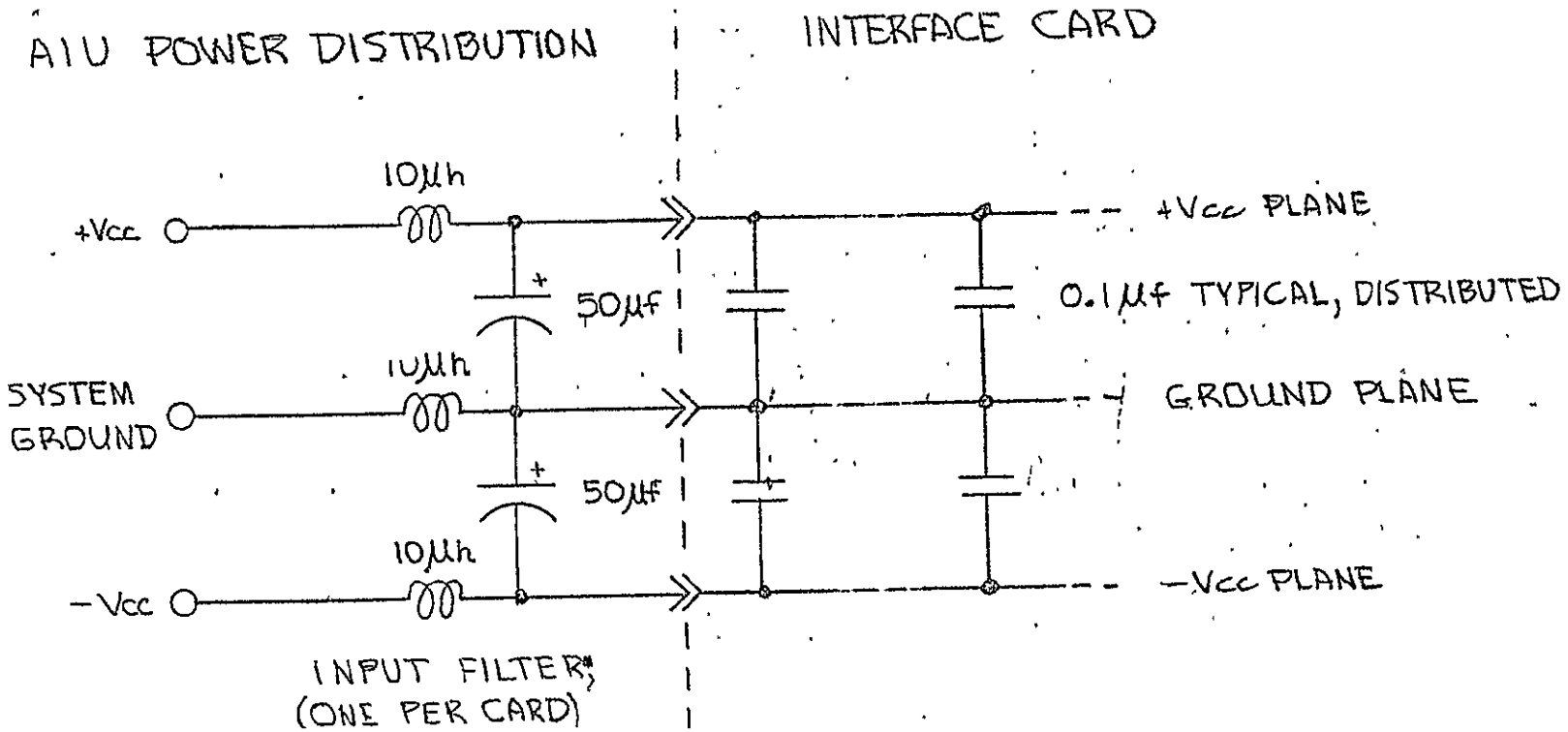


FIGURE 1: POWER DISTRIBUTION PLAN

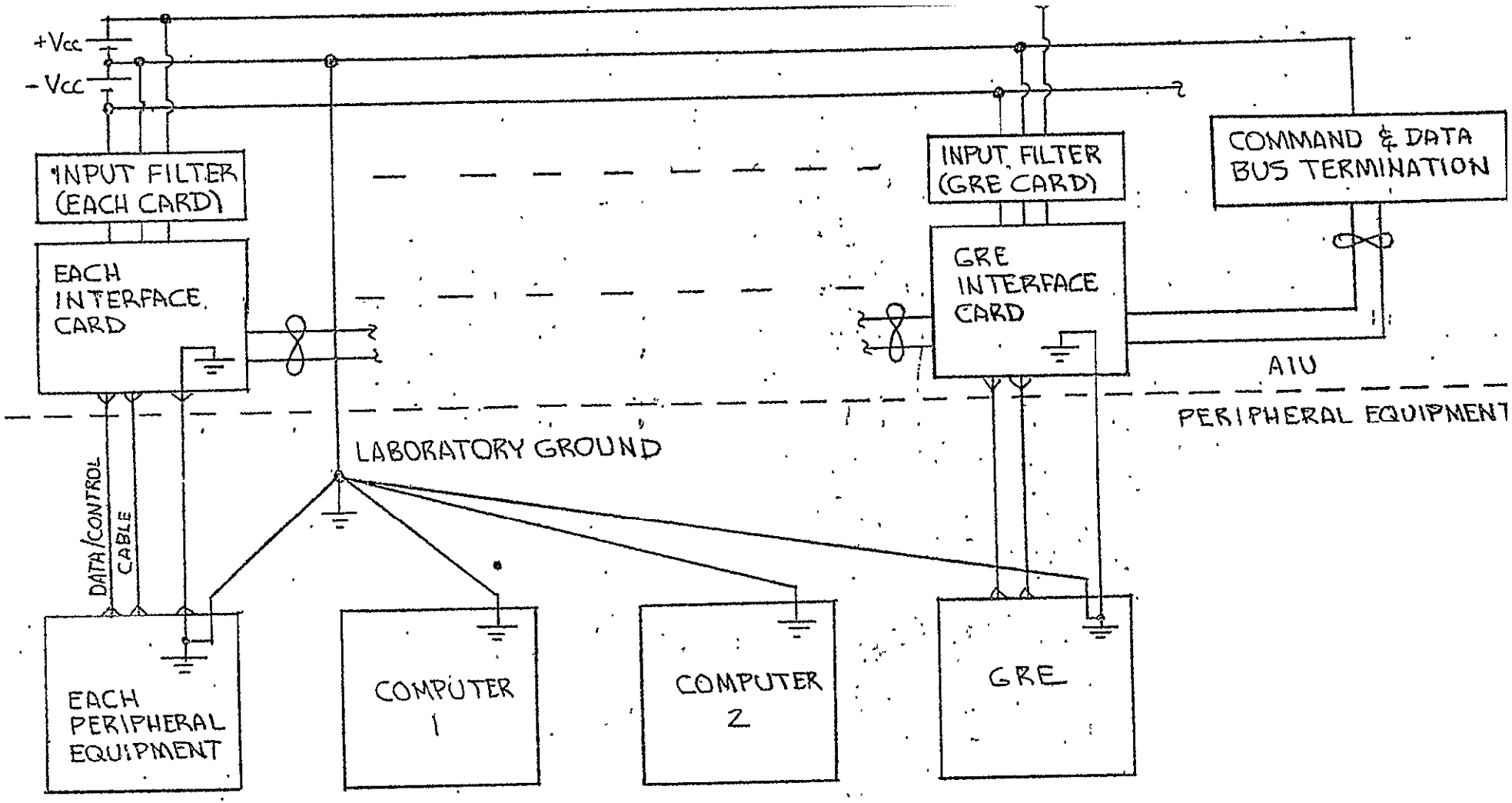


FIGURE 2: RECOMMENDED LABORATORY GROUNDING PLAN

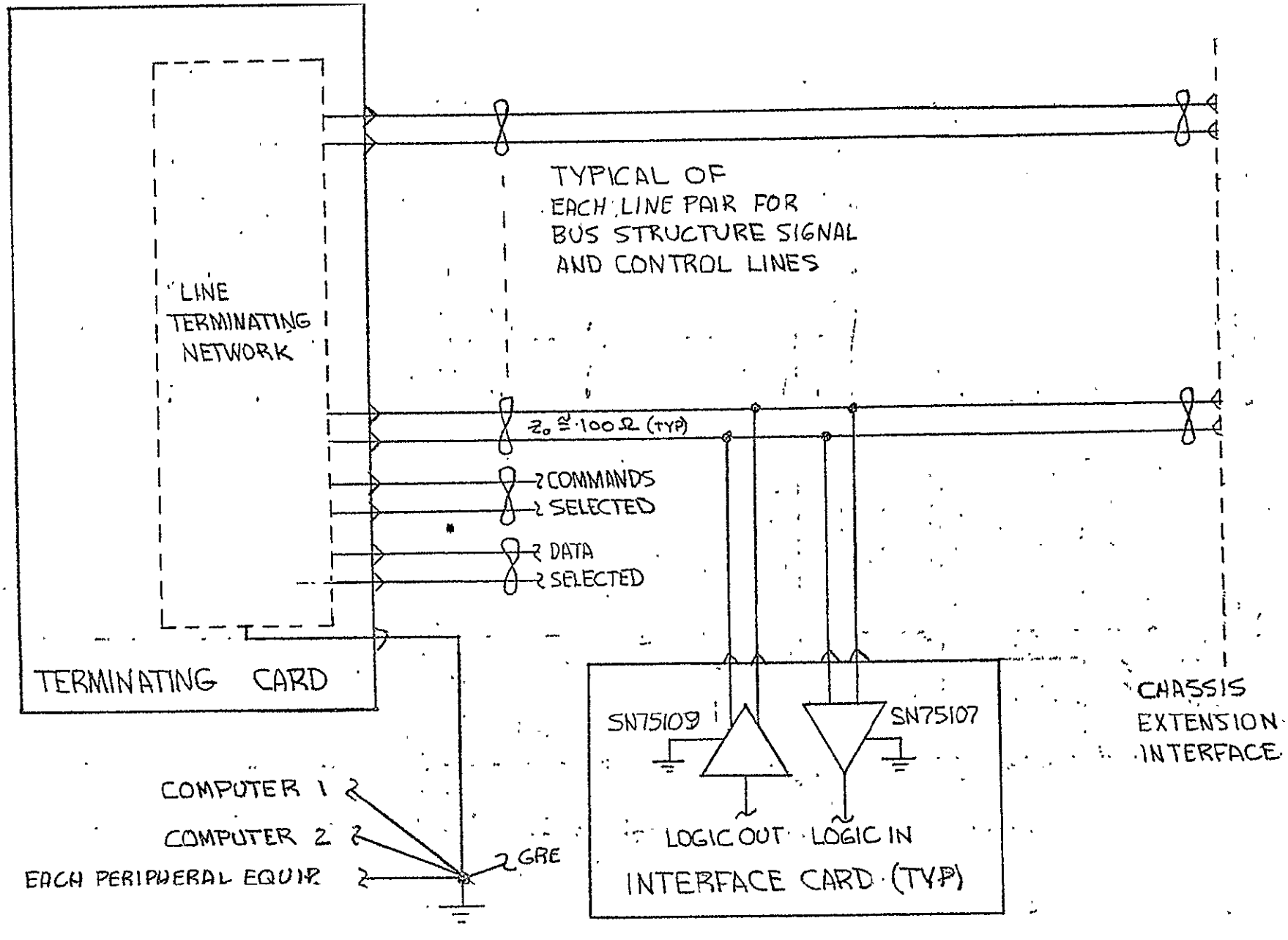
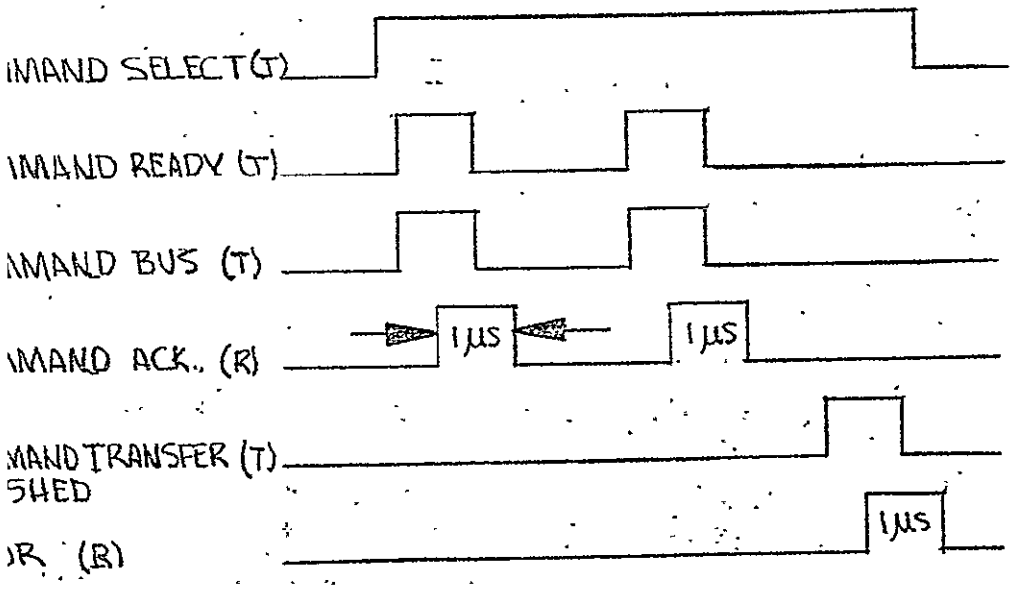
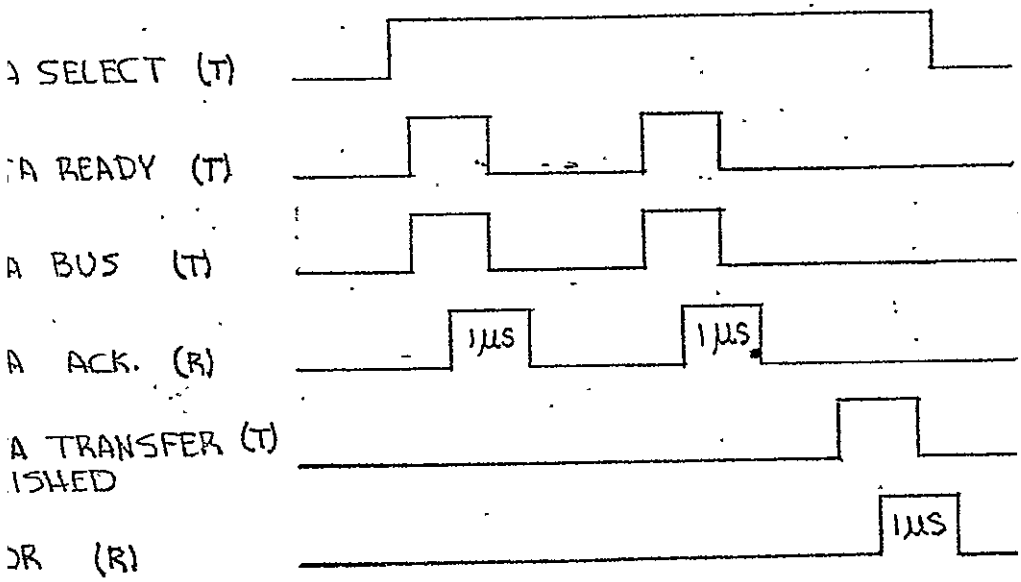


FIGURE 3: INTERFACE BUS STRUCTURE



COMMAND TRANSFER TIMING

NOTE: (T) – ORIGINATED BY TRANSMITTER
(R) – RESPONSE FROM RECEIVER



DATA TRANSFER TIMING

FIGURE 4: VIPS TIMING DIAGRAMS

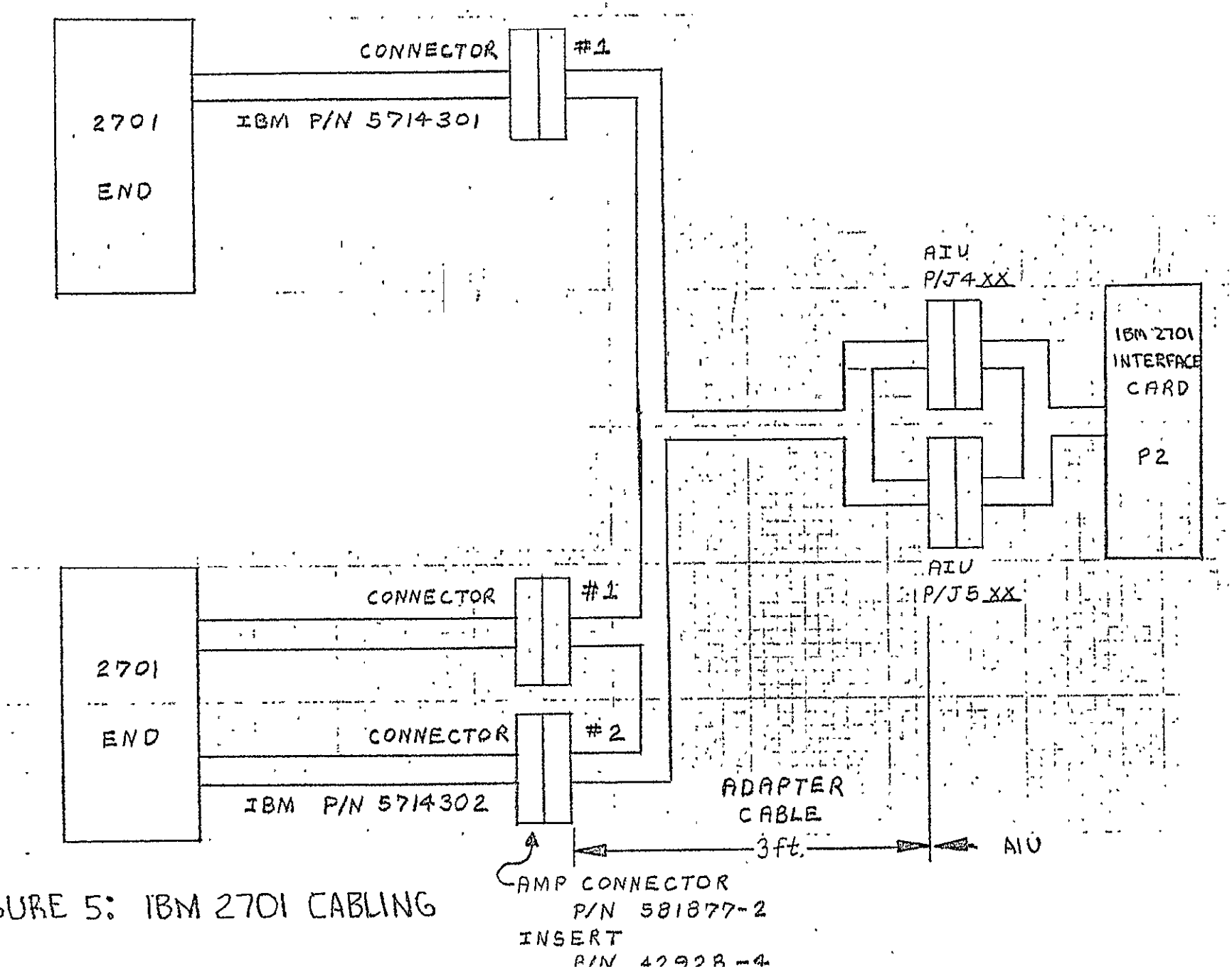


FIGURE 5: IBM 2701 CABLING

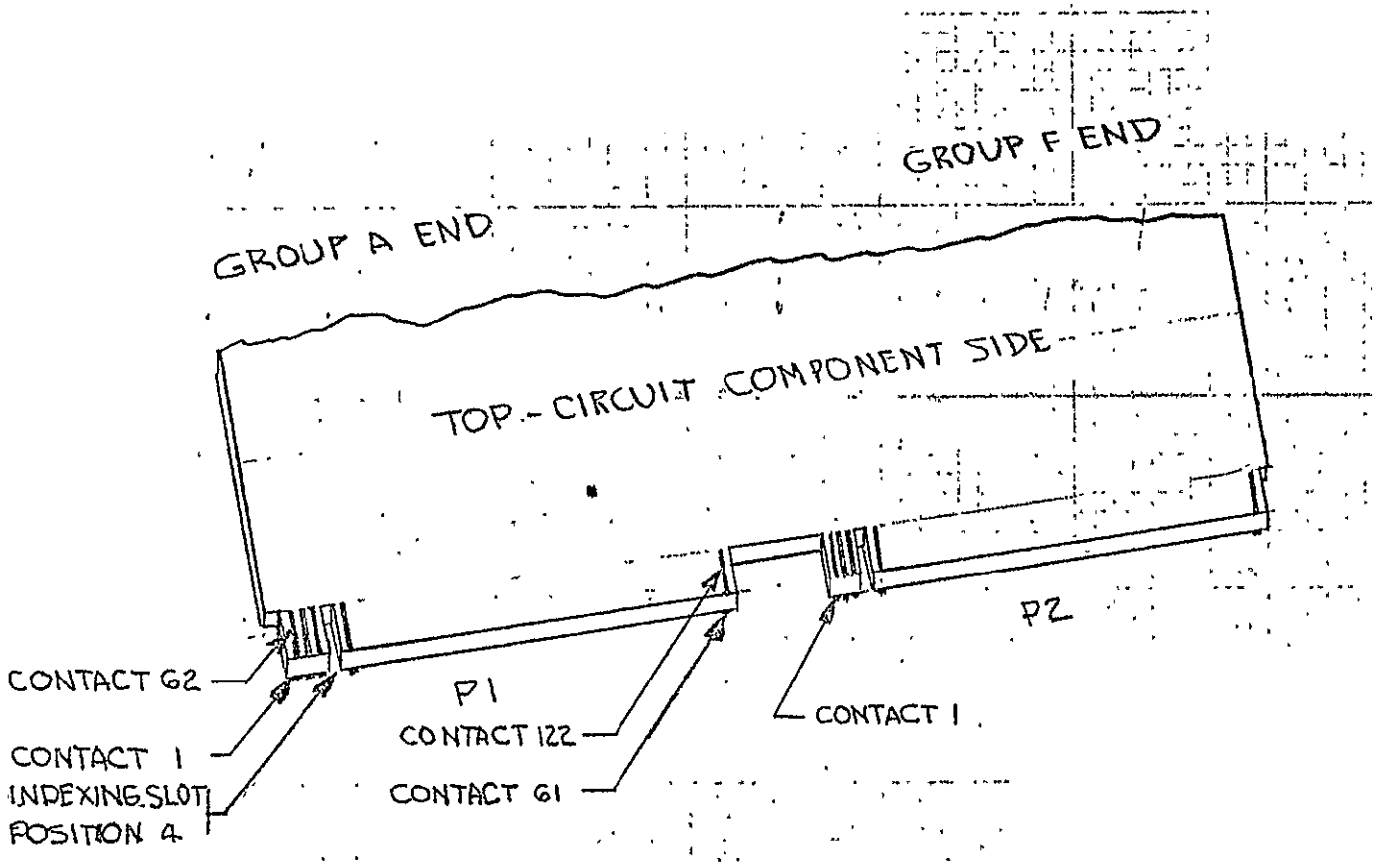


FIGURE 6: CIRCUIT BOARD CONTACT POSITION DIAGRAM

4.1 DETAILED WIRE LISTING FOR THE IBM 2701 INTERFACE CARD (VIPS-021-4)

DETAIL WIRE LISTING FOR THE IBM 2701 INTERFACE CARD

FH50 - FH32
FH32 - FH24
FH24 - FH16
FH16 - FH8
FH8 - FB8
FB8 - FB16
FB16 - FB24
FB24 - FB32
FB32 - FB50
FB50 - FH50
FB50 - EJ50
EJ50 - EJ40
EJ40 - EJ24
EJ24 - EJ8
EJ8 - FB8
FJ32 - FJ25
FJ24 - FJ17
FJ16 - FJ9
FJ8 - FJ1
FC32 - FC75
FC24 - FC17
FC16 - FC9
FC8 - FC1
FA40 - FA33
FA24 - FA1
FA8 - FA1
+Vcc - FD41
+Vcc - FF40
+Vcc - FF32
+Vcc - FF24
+Vcc - FF16
+Vcc - FF8

+Vcc - FD32
+Vcc - FD24
+Vcc - FD16
+Vcc - FD8
+Vcc - EG40
+Vcc - EG32
+Vcc - EG24
+Vcc - EG16
+Vcc - EG8
GND - FJ32
GND - FJ24
GND - FJ16
GND - FJ8
GND - FG40
GND - FG32
GND - FG24
GND - FG16
GND - FG8
GND - FE40
GND - FE32
GND - FE24
+5 - EJ32
+5 - EJ16
GND - FE41
GND - FE16
GND - FE8
GND - FA40
GND - FA32
GND - FA24
GND - FA16
GND - FA8
GND - EH40

GND - EH32
GND - EH24
GND - EH16
GND - EH8
FB22 - FB24
FB14 - FB6
FB 6 - EJ6
EJ38 - EJ22
EJ22 - EJ24
EJ6 - EJ8
EG16 - EG15
EG8 - EG7
EE24 - EE23
FF32 - FH31
FF24 - FH23
FF16 - FH15
FF8 - FH7
EJ32 - FB31
FD24 - FB23
EJ16 - FB15
FD8 - FB7
EG40 - EJ39
EG24 - EJ23
EG8 - EJ7
FF40 - FF39
FF32 - FF31
FF24 - FF23
FF16 - FF15
FF8 - FF7
FD41 - FD39
FD32 - FD31
FD24 - FD23

FD16 - FD15
FD8 - FD7
EJ32 - EJ31
EJ16 - EJ15
EG40 - EG39
EG32 - EG31
EG24 - EG23
FH32 - FH30
FH24 - FH22
FH16 - FH14
FH8 - FH6
FB32 - FB30
+Vcc - EE41
+Vcc - EE24
+Vcc - EE16
+Vcc - EC32
+Vcc - EC16
+Vcc - EA33
+Vcc - EA17
+Vcc - DH35
+Vcc - DH9
+Vcc - DF41
+Vcc - DF25
+Vcc - DF9
+Vcc - DD33
+Vcc - DD9
+Vcc - DB33
+Vcc - DB17
+Vcc - CJ41
+Vcc - CJ25
+Vcc - CJ9
+Vcc - CG34

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

+Vcc - CG18
+Vcc - CE42
+Vcc - CE26
+Vcc - CE9
+Vcc - CC34
+Vcc - CC18
GND - EF41
GND - EF24
GND - EF16
GND - ED32
GND - ED16
GND - EB33
GND - EB17
GND - DJ35
GND - DJ9
GND - DG41
GND - DG25
GND - DG9
GND - DE33
GND - DE9
GND - DC33
GND - DC17
GND - DA41
GND - DA25
GND - DA9
GND - CH34
GND - CH18
GND - CF42
GND - CF26
GND - CF9
GND - CD34
GND - CD18

EJ50 - BH49
EJ6 - BD1
+Vcc - CA34
+Vcc - CA16
+Vcc - BH50
+Vcc - BH33
+Vcc - BH17
+Vcc - BD49
+Vcc - BD41
+Vcc - BD33
+Vcc - BD25
+Vcc - BD17
+Vcc - BD9
+Vcc - AJ49
+Vcc - AJ41
+Vcc - AJ33
+Vcc - AJ25
+Vcc - AJ17
+Vcc - AJ9
+Vcc - AE49
+Vcc - AE41
+Vcc - AE33
+Vcc - AE25
+Vcc - AE17
+Vcc - AE9
+Vcc - AA49
+Vcc - AA41
+Vcc - AA33
+Vcc - AA25
+Vcc - AA17
+Vcc - AA9
GND - BE1

GND - CB34
GND - CB16
GND - BJ50
GND - BJ33
GND - BJ17
GND - GE49
GND - BE41
GND - BE33
GND - BE25
GND - BE17
GND - BE9
GND - BA49
GND - BA41
GND - BA33
GND - BA25
GND - BA17
GND - BA9
GND - AF49
GND - AF41
GND - AF33
GND - AF25
GND - AF17
GND - AF9
GND - AB49
GND - AB41
GND - AB33
GND - AB25
GND - AB17
GND - AB9
BH49 - BF49
BF49 - BF41
BF41 - BF33

BF33 - BF25
BF25 - BF17
BF17 - BD1
BF49 - BB49
BB49 - BB41
BB41 - BB33
BB33 - BB25
BB25 - BB17
BB17 - BB9
BB9 - BD7
BB49 - AG49
AG49 - AG41
AG41 - AG33
AG33 - AG25
AG25 - AG17
AG12 - AG9
AG9 - BB7
AG49 - AC49
AC49 - AC41
AC41 - AC33
AC33 - AC25
AC25 - AC17
AC17 - AC9
AC9 - AG7
GND - BJ49
GND - BG49
GND - BG41
GND - BG33
GND - BG25
GND - BG17
GND - BC49
GND - BC41

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

GND - BC33
GND - BC25
GND - BC17
GND - BC9
GND - AH49
GND - AH41
GND - AH33
GND - AH25
GND - AH17
GND - AH9
GND - AD49
GND - AD41
GND - AD33
GND - AD25
GND - AD17
GND - AD9
+Vcc - EF45
+Vcc - EF36
+Vcc - EE31
+Vcc - EE15
+Vcc - EE7
EA48 - EC48
+Vcc - EC31
+Vcc - EC23
+Vcc - EC15
+Vcc - EC7
+Vcc - EA40
+Vcc - EA32
+Vcc - EA24
+Vcc - EA16
+Vcc - EA8
DH42 - EA46

DH16 - DJ18
DH8 - DH29
+Vcc - DF48
EA46 - DF40
DH30 - DF32
DH31 - DF24
DH18 - DF16
DH20 - DF8
+Vcc - DD48
+Vcc - DD40
GND - EE45
GND - EE36
GND - EF25
GND - EF9
GND - EF1
GND - ED42
GND - ED25
GND - EB17
GND - ED9
GND - ED1
GND - EB34
GND - EB26
GND - EB18
GND - EB10
GND - EB2
GND - DJ36
GND - DJ13
GND - DJ2
GND - DG42
GND - DG34
GND - DG26
GND - DG18

GND - DG13
GND - DG2
GND - DE42
GND - DE34
+Vcc - DD32
+Vcc - DD16
+Vcc - DD8
+Vcc - DB48
+Vcc - DB40
+Vcc - DB32
+Vcc - DC20
+Vcc - DC12
+Vcc - DC4
+Vcc - CJ48
+Vcc - CJ40
+Vcc - CJ32
+Vcc - CJ24
+Vcc - CJ16
+Vcc - CJ8
CC8 - CG49
+Vcc - CG41
+Vcc - CG33
+Vcc - CG25
+Vcc - CH13
+Vcc - CH4
+Vcc - CE49
+Vcc - CE41
+Vcc - CE33
+Vcc - CE25
+Vcc - CF13
GND - DE26
GND - DE10

GND - DE2
GND - DC42
GND - DC34
GND - DC26
GND - DB20
GND - DB12
GND - DB4
GND - DA42
GND - DA34
GND - DA26
GND - DA18
GND - DA10
GND - DA2
GND - CH43
GND - CH35
GND - CH27
GND - CH19
GND - CG13
GND - CG4
GND - CF43
GND - CF35
GND - CF27
GND - CF19
GND - CE13
+Vcc - CF4
+Vcc - CC49
+Vcc - CC41
+Vcc - CC33
CC4 - CC25
CC6 - CC17
+Vcc - CA49
+Vcc - CA41

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

+Vcc - CB29
+Vcc - CB20
+Vcc - CA15
+Vcc - CA7
+Vcc - BH40
+Vcc - BH32
+Vcc - BH24
+Vcc - BH16
+Vcc - BH8
+Vcc - BF8
GND - CE42
GND - CD43
GND - CD35
GND - CD27
GND - CD19
GND - CD11
GND - CB43
GND - CB35
GND - CA29
GND - CA20
GND - CB9
GND - CB1
GND - BJ34
GND - BJ26
GND - BJ18
GND - BJ10
GND - BG2
BJ6 - BJ2
AA49 - AA48
AC49 - AC47
AA41 - AA40
AC41 - AC39

AH33 - AA32
AC33 - AC31
AA25 - AA24
AC25 - AC23
AA17 - AA16
AC17 - AC15
AA9 - AA8
AC9 - AC7
AE49 - AE48
AG49 - AG47
AE41 - AE40
AG41 - AG39
AE33 - AE32
AG33 - AG31
AE25 - AE24
AG25 - AG23
AE17 - AE16
AG17 - AG15
AE9 - AE8
AG9 - AG7
AJ49 - AJ48
BB49 - BB47
AA49 - AC48
AC47 - AA45
AA41 - AC40
AC39 - AA37
AA33 - AC32
AC31 - AA29
AA25 - AC24
AC23 - AA21
AA17 - AC16
AC17 - AA13

AA9 - AC8
AC7 - AA5
AA25 - AG48
AG47 - AE45
AE41 - AG40
AG39 - AE37
AE33 - AG32
AG31 - AE29
AE25 - AG24
AG23 - AE21
AE17 - AG16
AG15 - AE13
AE9 - AG8
AG7 - AE5
AJ49 - BB48
BB47 - AJ45
GND - AB42
GND - AD42
GND - AB34
GND - AD34
GND - AB26
GND - AD26
GND - AB18
GND - AD18
GND - AB10
GND - AD10
GND - AB2
GND - AD2
GND - AF42
GND - AH42
GND - AF34
GND - AH34

GND - AF26
GND - AH26
GND - AF18
GND - AH18
GND - AF10
GND - AH10
GND - AF2
GND - AH2
GND - BA42
GND - BC42
AJ41 - AJ40
BB41 - BB39
AJ33 - AJ32
BB33 - BB31
AJ25 - AJ24
BB25 - BB23
AJ17 - AJ16
BB17 - BB15
AJ9 - AJ8
BB9 - BB7
BD49 - BD48
BF49 - BF47
BD41 - BD40
BF41 - BF39
BD33 - BD32
BF33 - BF31
BD25 - BD24
BF25 - BF23
BD17 - BD16
BF17 - BF15
BD9 - BD8
BH50 - BH48

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

AJ41 - BB40
BB39 - AJ37
AJ33 - BB32
BB31 - AJ29
AJ25 - BB24
BB23 - AJ21
AJ17 - BB16
BB15 - AJ13
AJ9 - BB8
BB7 - AJ5
BD49 - BF48
BF47 - BD45
BD41 - BF40
BF39 - BD37
BD33 - BF32
BF31 - BD29
BD25 - BF24
BF23 - BD21
BH17 - BF16
BF15 - BD15
BD1 - BD7
BH49 - BH45
GND - BA34
GND - BC34
GND - BA26
GND - GC26
GND - BA18
GND - BC18
GND - BA10
GND - BC10
GND - BA2
GND - BC2

GND - BE42
GND - BG42
GND - BE34
GND - BG34
GND - BE26
GND - BG26
GND - BE18
GND - BG18
GND - BE10
GND - BG10
GND - BE2
GND - BJ42
FA34 - FA18
FA18 - FA2
FJ26 - FJ18
FJ18 - FJ10
FJ10 - FJ2
FC26 - FC18
FC18 - FC10
FC10 - FC2
FJ49 - FG34
FH48 - FG35

FF35 - FJ47
FF34 - FJ47

FJ46 - FG27
FH46 - FG26

FJ45 - FF27
FH44 - FF26

FH43 - FG19
FJ44 - FG18

FH42 - FF19
FJ42 - FF18

FH39 - FG11
FJ40 - FG10

FH38 - FF11
FJ38 - FF10

FJ37 - FG3
FH37 - FG2

FG36 - FF3
FH35 - FF2

FH34 - FE35
FJ35 - FE34

FH33 - FD35
FJ33 - FD34

FD48 - FE27
FE49 - FE26

FD47 - FD27
FE47 - FD26

FE46 - FE19
FD46 - FE18

FE45 - FD19
FD44 - FD19

FD43 - FE11
FE44 - FE10

FD42 - FD11
FE42 - FD10

EJ48 - FE3
FA49 - FE2

EJ47 - FD3
FA47 - FD2

FA46 - FA27
EJ46 - FA26

FA45 - FA11
EJ44 - FA10

EJ43 - EH35
FA44 - EH34

EJ42 - EH27
FA42 - EH26

FC37 - EH19
FB37 - EH18

FC36 - EH11
FB35 - EH10

FB34 - EH3
FC35 - EH2

FB33 - EF19
FC33 - EF18

+Vcc - FH45
FH45 - FJ43

FJ43 - FJ48

FJ34 - FH36

+Vcc - FJ34
FH36 - FJ39

FE43 - FD45

+Vcc - FE43

FD45 - FE48

FA43 - EJ45

+Vcc - FA43

EJ45 - FA48

FC34 - FB36

+Vcc - FC34

FB36 - FJ46

FF33 - FF34

FF25 - FF26

FF17 - FF18

FF9 - FF10

FF1 - FF2

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

FD33 - FD34
FD25 - FD26
FD17 - FD18
FD9 - FD10
FD1 - FD2
EJ25 - EJ26
EJ9 - EJ10
EG33 - EG34
EG25 - EG26
EG17 - EG18
EG9 - EG10
EG1 - EG2
EE17 - EE18
FF34 - FG33
FF26 - FG25
FF18 - FG17
FF10 - FG9
FF2 - FG1
FD34 - FE33
FD26 - FE25
FD18 - FE17
FD10 - FE9
FD2 - FE1
EJ26 - FA25
EJ10 - FA9
EG34 - EH33
EG26 - EH25
EG18 - EH17
EG10 - EH9
EG2 - EH1
EE18 - EF17
FG33 - FG34

FG25 - FG26
FG17 - FG18
FG9 - FG10
FG1 - FG2
FE33 - FE34
FE25 - FE26
FE17 - FE18
FE9 - FE10
FE1 - FE2
FA25 - FA26
FA9 - FA10
EH33 - EH34
EH25 - EH26
EH17 - EH18
EH9 - EH10
EH1 - EH2
EF17 - EF18
FG34 - GND
FG26 - GND
FG18 - GND
FG10 - GND
FG2 - GND
FE34 - GND
FE26 - GND
FE18 - GND
FE10 - GND
FE2 - GND
FA26 - GND
FA10 - GND
EH34 - GND
EH26 - GND
EH18 - GND

EH10 - GND
EH2 - GND
EF18 - GND
DD8 - DH27
DF32 - DH29
DF24 - DH31
DF16 - DH18
DF8 - DH20
DH16 - DH22
DH8 - DH24
DH42 - EA44
DF40 - EA46
CC33 - CC2
DD32 - DH33
CC25 - CC4
CC17 - CC6
DD16 - EA42
CG49 - CC8
EC48 - EH48
DJ28 - DD4
DJ30 - DF28
DJ32 - DF20
DJ19 - DF12
DJ21 - DF4
DJ23 - DH12
DJ25 - DH4
EB45 - DH38
EB47 - DF36
DJ27 - DD5
DJ29 - DF29
DJ31 - DF21
DJ18 - DF13

DJ20 - DF5
DJ22 - DH13
DJ24 - DH5
EB44 - DH39
EB46 - DF37
CD2 - CC30
DJ33 - DD29
CD4 - CC22
CD6 - CC14
EB42 - DD13
CD8 - CG46
EB48 - EC45
CD3 - CC29
DJ34 - DD28
CD5 - CC21
CD7 - CC13
EB43 - DD12
CD9 - CG45
EB49 - EC44
DD5 - DH28
DF29 - DH30
DF21 - DH32
DF13 - DH19
DF5 - DH21
DH13 - DH23
DH5 - DH25
DH39 - EA45
DF37 - EA47
CC30 - CC3
DD29 - DH34
CC22 - CC5
CC14 - CC7

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

DD13 - EA43
CG46 - CC9
EC45 - EA49
FG37 - EB40
FF37 - EB38
FG29 - EB36
FF29 - EA35
FG21 - EA37
FF21 - EA39
FG13 - EB32
FF13 - EB30
FG5 - EB28
FF5 - EA27
FE37 - EA29
FD37 - EA31
FE29 - EB24
FD29 - EB22
FE21 - EB20
FD21 - EA19
FE13 - EA21
FD13 - EA23
FE5 - EB16
FD5 - EB14
FA29 - EB12
FA13 - EA11
EH37 - EA13
EH29 - EA15
EH21 - EB8
EH13 - EB6
EB3 - EH4
EA2 - EF20
EB39 - FG36

EB37 - FF36
EB35 - FG28
EA34 - FF28
EA36 - FG20
EA38 - FF20
EB31 - FG12
EB29 - FF12
EB27 - FG4
EA26 - FF4
EA28 - FE36
EA30 - FD36
EB23 - FE28
EB21 - FD28
EB19 - FE20
EA18 - FD20
EA20 - FE12
EA22 - FD12
EB15 - FE4
EB13 - FD4
EB11 - FA28
EA18 - FA12
EA12 - EH36
EA14 - EH28
EB7 - EH20
EB5 - EH12
EH5 - EB4
EF21 - EA3
1 - FG42
62 - FG43
2 - FF44
63 - FF43
21 - FG45
82 - FG46

41 - FF47
102 - FF48
42 - FG48
103 - FG49
43 - FC42
104 - FC43
22 - FB43
83 - FB44
23 - FC45
84 - FC46
25 - FB47
86 - FB48
26 - FC48
87 - FC49
27 - EH42
88 - EH43
29 - EG43
90 - EG44
30 - EH45
91 - EH46
31 - EG47
92 - EG48
32 - EH48
93 - EH49
33 - ED33
94 - ED34
34 - EC34
95 - EC35
35 - ED36
96 - ED37
36 - EC38
97 - EC39

37 - ED39
98 - ED40
38 - DH44
99 - DH45
39 - DJ46
100 - DJ47
FF42 - FJ30
FG43 - FJ31
FG44 - FH28
FF43 - FH29
FF46 - FJ22
FG46 - FJ23
FG47 - FH20
FF48 - FH21
FF49 - FJ14
FG49 - FJ15
FB42 - FH12
FC43 - FH13
FC44 - FJ6
FB44 - FJ7
FB46 - FH4
FC46 - FH5
FC47 - FC30
FB48 - FC31
FB49 - FB28
FC49 - FB29
EG42 - FC22
EH43 - FC23
EH44 - FB20
EG44 - FB21
EG46 - FC14
EH46 - FC15

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

EH47 - FB12
EG48 - FB13

EG49 - FC6
EH49 - FC7

EC33 - FB4
ED34 - FB5

ED35 - FA38
EC35 - FA39

EC37 - EJ36
ED37 - EJ37

ED38 - FA22
EC39 - FA23

EC40 - EJ20
ED40 - EJ21

DJ45 - FA6
DH45 - FA7

DH47 - EJ4
DJ47 - EJ5

GND - FJ31
GND - FH29
GND - FJ23
GND - FH21
GND - FJ15
GND - FH13
GND - FJ7
GND - FH5
GND - FC31
GND - FB29
GND - FC23
GND - FB21
GND - FC15
GND - FB13

GND - FC7
GND - FB5

GND - FA39
GND - FJ37

GND - FA23
GND - EJ21

GND - FA7
GND - EJ5

3 - EJ48
64 - FA49

53 - FH48
114 - FJ49

5 - FJ46
66 - FH46

6 - FJ45
67 - FH44

7 - FH43
68 - FJ44

8 - FH42
69 - FJ42

9 - FH39
70 - FJ40

10 - FH38
71 - FJ38

11 - FJ37
72 - FH37

12 - FJ36
73 - FH35

13 - FH34
74 - FJ35

14 - FH33
75 - FJ33

15 - FD48
76 - FE49

16 - FD47
77 - FE47

17 - FE46
78 - FD46

18 - FE45
79 - FD44

19 - FD43
80 - FE44

20 - FD42
81 - FE42

40 - FH47
101 - FJ47

44 - EJ47
105 - FA47

45 - FA46
106 - FJ46

46 - FA45
107 - EJ44

47 - EJ43
108 - FA44

48 - EJ42
109 - FA42

49 - FC37
10 - FB37

50 - FC36
11 - FB35

51 - FB34
12 - FC35

2 - FB33
13 - FC33

Vcc - FF45
Vcc - FB45
Vcc - EG45
Vcc - EC36
Vcc - DH46

29 - AD48
90 - AD47

32 - AC46
93 - AC45

31 - AD40
92 - AD39

50 - AA39
110 - AA38

51 - AA39
112 - AA34

52 - AA31
113 - AA30

53 - AA27
114 - AA26

54 - AA23
115 - AA22

34 - AA19
95 - AA18

39 - AA15
100 - AA14

40 - AA11
101 - AA10

41 - AA7
102 - AA6

42 - AA3
103 - AA2

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

32 - AA43	43 - BG40	12 - AE7	15 - AG30
93 - AA42	104 - BG39	73 - AE6	76 - AG29
31 - AA47	44 - BF38	13 - AE3	16 - AH32
92 - AA46	105 - BF37	74 - AE2	77 - AH31
50 - BB14	45 - BG32	14 - AJ47	17 - AG38
111 - BB13	106 - BG31	75 - AJ46	78 - AG37
51 - BC8	46 - BF30	15 - AJ43	18 - AH40
112 - BC7	107 - BF29	76 - AJ42	79 - AH39
52 - BB6	47 - BG24	16 - AJ39	19 - AG46
113 - BB5	108 - BG23	77 - AJ38	80 - AG45
53 - BE16	48 - BF22	17 - AJ35	20 - AH48
114 - BE15	109 - BF21	78 - AJ34	81 - AH47
54 - BD14	49 - BG16	18 - AJ31	21 - AC6
115 - BD13	110 - BG15	79 - AJ30	82 - AC5
39 - BE8	43 - AE47	19 - AJ27	22 - AD8
100 - BE7	104 - AE46	80 - AJ26	83 - AD7
40 - BD6	44 - AE43	20 - AJ23	23 - AJ11
101 - BD5	105 - AE42	81 - AJ22	84 - AJ10
41 - BG48	45 - AE39	21 - AJ19	24 - AJ7
102 - BG47	106 - AE38	82 - AJ18	85 - AJ6
42 - BF46	46 - AE35	22 - AJ15	25 - AJ3
103 - BF45	107 - AE34	83 - AJ14	86 - AJ2
35 - AC38	47 - AE31	10 - AC14	1 - BD47
96 - AC37	108 - AE30	71 - AC13	62 - BD46
9 - BH47	48 - AE27	11 - AG14	38 - AG6
70 - BH46	109 - AE26	72 - AG13	99 - AG5
6 - AC30	49 - AE23	12 - AH16	37 - BD39
67 - AC29	110 - AE22	73 - AH15	98 - BD38
35 - AE19	10 - AE15	13 - AG22	2 - BD35
96 - AE18	71 - AE14	74 - AG21	63 - BD34
9 - AD32	11 - AE11	14 - AH24	5 - BC39
70 - AD31	72 - AE10	75 - AH23	66 - BC40

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

7 - BB38
66 - BB37

8 - BC31
69 - BC32

57 - BC16
118 - BC15

56 - BC24
117 - BC23

33 - BB21
94 - BB22

3 - BB29
64 - BB30

23 - AD16
84 - AD15

24 - AC22
85 - AC21

25 - AD24
86 - AD23

1 - AH8
62 - AH7

38 - BD43
99 - BD42

37 - BC48
98 - BC47

2 - BB46
63 - BB45

7 - BD31
66 - BD30

8 - BD27
69 - BD26

33 - BD23
94 - BD22

3 - BD19
64 - BD18

BB11 - CF49
BC5 - CF47
BB3 - CE44
BF13 - CE46
BD11 - CF45
BB11 - C31
BC5 - C7
BB3 - C28
BE13 - C4
BD11 - C25
C8 - CD41
C29 - CD40
C5 - CD39
C26 - CD38
C2 - CD37
CD37 - CD36
CD36 - CC39
CC39 - CC40
CF48 - C30
CF46 - C6
CE43 - C27
CE45 - C3
CF44 - C24
EE1 - FJ4
EE2 - FH2
EE3 - FC28
EE4 - FB26
EE5 - FC20
EE6 - FB18
EF7 - FC12

EF6 - FB10
EC1 - FC4
EC2 - FB2
EC3 - FA36
EC4 - EJ34
EC5 - FA20
EC6 - EJ18
ED7 - FA4
ED6 - EJ2
EF26 - FJ27
FJ27 - FG39
FJ27 - FJ19
FJ19 - FJ3
FJ3 - FH1
FH1 - FC27
FC27 - FB25
FB25 - FC19
FC19 - FB17
EF28 - FC11
FC11 - FB9
FB9 - FC3
FC3 - FB1
FB1 - FA35
FA35 - EJ33
EJ33 - FA19
FA19 - EJ17
EJ17 - FA3
FA3 - EJ1
EF30 - FJ11
FJ11 - FH9
FH9 - FE7
EF14 - FG31

FG31 - FG23
FG23 - FG15
FG15 - FG7
FG7 - FE39
EF12 - FE31
FE31 - FE23
FE23 - FE15
BE24 - BE23
AF15 - AF16
AF11 - AF12
AF7 - AF8
AF3 - AF4
BA48 - BA47
BA43 - BA44
BA39 - BA40
BA35 - BA36
BA31 - BA32
BA27 - BA28
BA23 - BA24
BA19 - BA20
BA15 - BA16
BA7 - BA8
BA11 - BA12
BA3 - BA4
AB39 - AB40
AB35 - AB36
AB31 - AB32
AB27 - AB28
AB23 - AB24
AB19 - AB20
AB15 - AB16
AB11 - AB12

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

AB7 - AB8	BJ7 - AB5	ED2 - EF4	BE4 - BD2
AB3 - AB4	BG3 - AB20	EF2 - DA38	BD2 - BG44
AF47 - AF48	BF2 - AB4	EF2 - ED27	BG44 - BF42
AF43 - AF44	BF3 - AF48	FJ20 - ED22	BF42 - BG36
AF39 - AF40	BF4 - AF44	ED22 - EC22	BG36 - BF34
AF35 - AF36	BF5 - AF40	CA37 - CA43	BF34 - BG28
AF31 - AF32	BF6 - AF36	CA43 - BH34	BG28 - BF26
AF27 - AF28	BF7 - AF32	BH34 - BH26	BF26 - BG20
AF23 - AF24	BG8 - AF28	BH26 - BH18	BG20 - BF18
BJ22 - AF16	BG7 - AF24	CA39 - BH10	BF18 - BH12
BJ19 - AF12	BG6 - BJ4	BH10 - CA1	CF31 - EE26
BH19 - AF8	BG5 - BJ3	CA1 - CA9	EE25 - BB26
BH22 - AF4	EE1 - BJ23	BJ5 - FC40	AH28 - AG26
BJ30 - BA48	EE2 - BJ20	BJ6 - BJ2	AH28 - AH20
BJ27 - BA44	EE3 - BH20	BJ5 - CB49	AH20 - AG18
BH27 - BA40	EE4 - BH23	CB49 - BJ40	AH20 - AH12
BH30 - BA36	EE5 - BJ31	BJ40 - BJ32	AH12 - AG10
BJ38 - BA32	EE6 - BJ28	BJ32 - BJ24	AH12 - AH4
BJ35 - BA28	EF7 - BH28	BJ24 - BJ16	CF28 - BJ46
BH35 - BA24	EF6 - BH31	BJ16 - CB7	BJ46 - AF14
BH38 - BA20	EC1 - BJ39	CB7 - CB15	AF14 - AF13
CB48 - BA16	EC2 - BJ36	BC20 - BB10	AF13 - AF6
CB45 - BA12	EC3 - BH36	BB10 - BB42	AF6 - AF5
CA45 - BA8	EC4 - BH39	AD28 - AC26	AF5 - BA46
CA47 - BA4	EC5 - CB48	BB42 - AD44	BA46 - BA45
BH2 - AB90	EC6 - CB45	AD44 - AC42	BA45 - BA38
BH3 - AB46	ED7 - CA45	AC42 - BC12	BA38 - BA37
BH4 - AB32	ED6 - CA48	BC12 - BC4	BA37 - BA30
BH5 - AB25	DA16 - FJ20	BC4 - BB2	CE27 - BA29
BH6 - AB24	DA15 - ED5	BB2 - BE12	BA29 - BA22
BH7 - AB16	FJ20 - ED4	BE12 - BD10	BA22 - BA21
BJ8 - AB12	ED3 - EF5	BD10 - BE4	BA21 - BA14

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

BA14 - BA13
BA13 - BA6
BA6 - BA5
BA5 - BE46
BE46 - BE37
BE37 - BC36
BC36 - BE30
AF22 - AG2
AG2 - BE38
BE38 - BB18
BB34 - BE29
BC27 - DC31
BB34 - BE21
DC32 - BE22
BE22 - BC44
BE22 - BE45
CA33 - BH2
CA32 - BH3
CA26 - BH4
CA25 - BH5
CA24 - BH6
CB13 - BH7
CB10 - BJ8
CA10 - BJ7
CA13 - BF2
CB5 - BF3
CB2 - BF4
CA2 - BF5
CA5 - BF6
BJ14 - BF7
BJ11 - BG8

BH11 - BG7
AB46 - AB45
AB45 - CE29
AB46 - AB38
AB38 - AB37
AB37 - AB30
AB30 - AB29
AB29 - AB22
AB22 - AB21
AB21 - AB14
AB14 - AB13
AB13 - AB6
AB6 - AB5
CE31 - AF46
AF46 - AF45
AF45 - AF38
AF38 - AF37
AF37 - AF30
AF30 - AF29
AF29 - AF22
AF21 - DF46
AC34 - AF22
CF32 - AD28
AC26 - AD20
AD20 - AC18
AC18 - AD12
AD12 - AC10
AC10 - AD4
AD4 - AC2
AC2 - AH44
AH44 - AG42

AG42 - AH36
CF30 - AG34
AG34 - AH28
CA48 - BH12
CA45 - BJ12
CB45 - BJ15
CB48 - CA6
BH39 - CA3
BH36 - CB3
BJ36 - CB6
BJ39 - CA14
BH31 - CA11
BH28 - CB11
BJ28 - CB14
BJ31 - CB28
BH23 - CB27
BH20 - CB28
BJ20 - CB31
BJ23 - CB32
CA14 - CF16
CB6 - CF15
CA3 - CF12
CA3 - CF11
CA6 - CF7
BJ15 - CF6
BJ12 - CF2
BH12 - CE1
ED18 - CF14
CF14 - CE14
CE14 - CF5
CF5 - CE5

CE5 - CA21
CA21 - CA30
CA30 - CB30
CJ35 - DE44
CJ35 - DA28
DC38 - FC40
CF17 - CG11
CE15 - CH10
CE12 - CH15
CF10 - CH17
CF8 - CG2
CF6 - CH1
CE3 - CH6
CF1 - CH8
CG15 - CG5
EF29 - EF27
DJ38 - DJ39
DJ39 - FB39
DJ37 - DC15
DC15 - DC14
DC14 - DC7
DC7 - DC6
DJ42 - EC12
DJ42 - DD47
DD47 - CH25
DD47 - DE48
DD44 - CJ36
DA32 - CG19
CJ36 - DC37
DC8 - DB6
DB8 - DB34

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

DC39 - DB38
DB38 - DA35
DC36 - DB35
DB35 - DC34
DB36 - DC34
DB36 - DB37
CB37 - DC44
CB37 - CG32
CB36 - CG22
CG20 - DC47
DC47 - DC48
CG24 - CB38
CG23 - CH21
CH21 - DD46
DD45 - CA35
DD43 - CG28
CG28 - CG29
CG36 - CG31
CG31 - DA46

DA45 - CJ47
CH23 - CH28
CH24 - DJ39
EC10 - CB40
CB41 - DF44
ED30 - DA44
DA43 - CG38
DA45 - CG40
CG39 - DB26
CG35 - DA48
CG36 - BE35
BE35 - BE36

CG36 - CE28
EF31 - EF29
EF31 - ED15
DJ3 - EC29
EC29 - CD47
CG10 - CF25
CH12 - CF24
CH16 - CF22
CG16 - CF21
CG1 - CE20
CH3 - CE21
CH7 - CE23
CG7 - CE24
CF20 - CH32
CF19 - CH30
CH30 - CH29
CG13 - CG14
CG12 - DB6
CH11 - CJ5
CH12 - DA8
CG17 - CJ3
CH11 - DB3
CH14 - DB2
CG17 - DB5
DB5 - DB16
CG3 - DA6
DA6 - DB14
CH2 - DA4
DA4 - DB11
CH5 - CJ13
CJ13 - DB10
CG8 - CJ15

CJ15 - DB13
DB6 - CJ28
CJ28 - CJ30
CJ30 - CJ31
DA24 - DA23
CJ4 - DA23
DA7 - DA22
CJ2 - DA21
DA5 - DA20
DA3 - DA19
CJ12 - CJ21
CJ14 - CJ22
CJ18 - CJ15
CJ10 - CJ27
CJ26 - DE46
CJ26 - DA12
DA12 - ED20
ED20 - ED19
EE49 - FA31
EE48 - FA15
EE42 - EH31
EE40 - EH23
EE39 - EH15
EE34 - EH7
EE33 - EF23
FH18 - EF15
EF15 - EF13
EF13 - ED13
ED13 - CF37
CF37 - DB46
CF37 - CF33
CF33 - CF31

FJ12 - DC30
DC30 - DB47
FH10 - CJ45
CJ45 - CJ44
CJ44 - BE32
BE32 - BE31
DG45 - DC28
DC27 - FA30
CD15 - CD14
CD14 - CD11
BE28 - BE27
CD12 - BE27
BC13 - DB29
CH44 - BE24
CH47 - CH46
CH46 - CH43

DE39 - BB19
CD23 - CD22
CD22 - CD19
CD20 - BE44
BE44 - BE43
DC43 - BE40
BE40 - BE39
CD29 - CH24
CD29 - CD30
CD28 - BE20
BE20 - BE19
CF36 - DB27
DB27 - DA47
DA47 - DB43
DB43 - BB43

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

CJ46 - AF20
AF20 - AF19
CF38 - DB44
DB44 - AH5
ED30 - EC18
EC25 - EC9
EC26 - FB38
EC27 - EC28
EC28 - ED25
DA44 - DA37
DA37 - CH37
CH37 - ED14
EC17 - FF38
EC21 - BJ48
BJ48 - BJ47
ED23 - CG27
DE28 - CC47
CC47 - CC48
CC48 - CA38
DE32 - CC46
DE20 - DE30
DE30 - DE26
DF45 - DF46
DF45 - CH37
DF47 - DG47
DG48 - AD45
DA11 - DA29
DA29 - CJ37
DE47 - FB38
DE47 - ED45
ED45 - ED44

ED43 - EE46
EE46 - EF46
EF46 - EE37
EE37 - EF37
FJ28 - ED11
ED11 - DA36
DA36 - DA31
DA31 - ED29
ED29 - ED38
DA36 - CB37
DA39 - FH26
DA39 - CJ39
EE29 - DA40
CJ38 - CG39
CF40 - ED44
DG40 - DE40
DE36 - DE16
DE37 - BB27

CF40 - DE13
DE13 - DE12
DC29 - CE38
CE38 - CE39
CF39 - CF40
CF40 - CF41
CF41 - DG35
DG38 - DG37
DG37 - DG34
EC11 - DA14
DA13 - EC19
EC19 - EC20

EE38 - ED12
BE5 - EF48
BD3 - EF47
BG45 - EF44
BF43 - EF43
BG37 - EF39
BF35 - EF38
BG29 - EF35
BF27 - EF34
CF29 - CE28
CC44 - BE48
BE48 - BE47
AD37 - ED10
DE6 - DE5
DE5 - DE2
DG30 - DG29
DG29 - DG26
DG22 - DG21
DG21 - DG18
DG14 - DG13
DG13 - DG10
DG6 - DG5
DG5 - DG2
DJ14 - DJ13
DJ13 - DJ10
DJ6 - DJ5
DJ5 - DJ2
DJ3 - ED21
DG35 - FD6
DA27 - CA40
CA40 - AB48

AB48 - AB47
CJ34 - AB44
DC45 - CJ34
CE32 - CE30
CE32 - AB44
AB44 - AB43
EE30 - CD49
CD49 - AC43
EC14 - CB49

CJ42 - DG44

DF42 - AC35
CE48 - CC35
CE47 - CD48
BC21 - EH38
BC18 - EH33
BB35 - FA14
BC34 - FA9
DG32 - DG20
DG26 - DG18
DG16 - DG4
DG10 - DG2
DJ16 - DJ4
DJ10 - DJ2
EE27 - DE4
EE25 - DE2
DE4 - DG12
DE2 - DG10

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

DG12 - DJ12
DG10 - DJ10
DJ3 - CJ33
DE4 - DG28
DE2 - DG26
CD44 - ED46
CD43 - ED42
DB42 - DG36
DC42 - DG34
DE43 - DE14
DE42 - DE10
AE35 - CD11
AF34 - CD9
CE35 - CD31
BC45 - CD21
BC42 - CD19
CH45 - CD45
CH43 - CD43
DG46 - DJ40
DG42 - DJ36
CH27 - DE26
CG27 - DE28
AC11 - FD14
AD10 - FE9
FE14 - AG11
FE9 - AH10
AD29 - FE6
AD26 - FE7
AC27 - FG39
AD26 - FG33
AD21 - FG30
AD18 - FG25
AC19 - FF30
AD18 - FG25
AD13 - FG22
AD10 - FG17
AD5 - FF22
AD2 - FG17
AC3 - FG14
AD2 - FG9
AH45 - FF14
AH42 - FG9
AG43 - FG6
AH42 - FG1
AH37 - FF6
AH34 - FF1
AG35 - FE38
AH34 - FE33
AH29 - FD38
AH26 - FE33
AG27 - FE30
AH26 - FE25
AH21 - FD30
AH18 - FE25
AG19 - FE22
AH18 - FE17
AH13 - FD22
AH10 - FE17
FB6 - DE35
GND - DG18
GND - DG26
DG27 - DG20
GND - DG21
DD42 - DA32
ED11 - ED29
DA31 - CB37
DE3 - DA36
FC38 - FJ26
FC38 - FC26
FC38 - FA34
+VCC - FC39
AD43 - DA35
AH11 - AD35
AH11 - AH3
AH3 - BC35
BC35 - BC13
FC40 - BJ5
CB49 - BJ5
GND - CB9
DE35 - FD6
CE35 - CD31
GND - DG13
GND - DJ13
GND - BF1
GND - FA8
GND - FC8
GND - FC16
GND - FC24
GND - FC32
AA44 - AB45
AA36 - AB37
AA28 - AB29
AA20 - AB21
AA12 - AB13
AA4 - AB5
AE40 - AF45
AE36 - AF37
AE28 - AF29
AE20 - FB39
AE20 - BH44
GND - BJ45
AD19 - AD20
AD11 - AD12
AD3 - AD4
AH43 - AH44
AH35 - AH36
AH27 - AG26
AH19 - AG18
AF12 - AF13
AE4 - AF5
AJ44 - BA45
AJ36 - BA37
AJ28 - BA29
AJ20 - BA21
AJ12 - BA13
AJ4 - BA5

Detail Wire Listing for the IBM 2701 Interface Card (Cont'd)

BD44 - BH44
BD36 - BD44
BD28 - BD36
FB40 - BC20

BC11 - BC12
BC19 - BD28
BD20 - BC19
BC3 - BC19
BC3 - BE11
BE11 - BE3
BE3 - BG43
BG43 - BG35
BG35 - BG27
BG27 - BG19
BG19 - BG11
BF10 - GND
EH39 - EE43
FH25 - FJ26
FH17 - FJ18
CJ38 - CH39
BC19 - CH40
ED27 - ED2
AD45 - DG46
DG48 - DJ40
CA35 - CJ43
CJ43 - EC13
CA36 - DD45

38 - AG5
99 - AG6
CH22 - CH24
CH22 - DD49
CH22 - CG21

Tucc - 1K
1K - CF32

+Vcc - 1K
1K - CF30

+Vcc - 1K
1K - CF28

+Vcc - 1K
1K - CE27

+Vcc - 1K
1K - CE29

+Vcc - 1K
1K - CE31

+Vcc - 1K
1K - EF14

+Vcc - 1K
1K - EF12

DA46 - DB28
DB29 - FH10
CG28 - CJ47
CG37 - CG21
CH38 - CH40
CD46 - CG37
CC45 - CD46
DE45 - DD44
BC29 - DB31
DB30 - DG43
BC27 - BD20
BB26 - BC28
BB26 - BE30
CH45 - BE22
BC37 - DC32
DC31 - DF43

GROUP A
UPPER ROW

1	=	AB48
2	=	AB44
3	=	BE24
4	=	BE40
5	=	BE44
6	=	AF20
7	=	AH12
8	=	AB40
9	=	AB36
10	=	AB32
11	=	AB28
12	=	AB24
13	=	AB16
14	=	AB12
15	=	AB8
16	=	AB4
17	=	AF48
18	=	AF44
19	=	AF40
20	=	AF36
21	=	AF32
22	=	AF28
23	=	AF24

GROUP A
LOWER ROW

1	=	FD6
2	=	FA30
3	=	FA14
4	=	EH38
5	=	FF38
6	=	FG38
7	=	FE6
8	=	FG30
9	=	FF30
10	=	FG22
11	=	FF22
12	=	FG14
13	=	FF14
14	=	FG6
15	=	FF6
16	=	FE38
17	=	FD38
18	=	FE30
19	=	FD30
20	=	FE22
21	=	FD22
22	=	FE14
23	=	FD14

GROUP F UPPER ROW		
1	=	FJ28
2	=	FH26
3	=	GND
4	=	FH18
5	=	FJ12
6	=	FH10
7	=	FJ20
8	=	FJ4
9	=	FH2
10	=	FC28
11	=	FB26
12	=	FC20
13	=	FB18
14	=	FC12
15	=	FB10
16	=	FC4
17	=	FB2
18	=	FA36
19	=	EJ34
20	=	FA20
21	=	EJ18
22	=	FA4
23	=	EJ2

GROUP F LOWER ROW		
1	=	BE48
2	=	BE36
3	=	BE20
4	=	BE32
5	=	BE28
6		
7	=	BJ48
8	=	AF16
9	=	AF12
10	=	AF8
11	=	AF4
12	=	BA48
13	=	BA44
14	=	BA40
15	=	BA36
16	=	BA32
17	=	BA28
18	=	BA24
19	=	BA20
20	=	BA16
21	=	BA12
22	=	BA8
23	=	BA4

PIN FUNCTION LIST FOR ADAPTER CABLE FROM IBM 2701 TO THE AIU:

FROM IBM 2701 CABLE
PART NO. 5714301 (AIU END)

	Connector	Pin	TO AIU	
Read Select	1	1	P/J4	58
	1	2		102
Write Select	1	3	P/J5	8
	1	4		12
Read Ready	1	7	P/J4	65
	1	8		70
Write Ready	1	9	P/J5	1
	1	10		4
Demand	1	11	P/J4	2
	1	12		5
Suppress Parity	1	13	P/J4	59
Error	1	14		63
Redundancy Error	1	17	P/J4	52
	1	18		55
WC=0	1	19	P/J4	73
	1	20		76
EOR	1	21	P/J4	10
	1	22		13
EOF	1	23	P/J4	16
	1	24		20
Interrupt	1	27	P/J4	23
	1	28		26
Parity IN	1	29	P/J5	15
	1	30		18
Parity OUT	1	31	P/J5	47
	1	32		50

PIN FUNCTION LIST FOR ADAPTER CABLE FROM IBM 2701 TO THE AIU:

FROM IBM 2701 CABLE
PART NO. 5714301 (AIU END)

	Connector	Pin	TO AIU
Data OUT 1	1	1	P/J5 53
	1	2	56
Data OUT 2	1	3	P/J5 59
	1	4	63
Data OUT 3	1	7	P/J5 74
	1	8	77
Data OUT 4	1	9	P/J5 3
	1	10	7
Data OUT 5	1	11	P/J5 11
	1	12	14
Data OUT 6	1	13	P/J5 24
	1	14	27
Data OUT 7	1	17	P/J5 30
	1	18	33
Data OUT 8	1	19	P/J5 36
	1	20	39
Data IN 1	1	21	P/J5 41
	1	22	44
Data IN 2	1	23	P/J5 35
	1	24	38
Data IN 3	1	27	P/J5 29
	1	28	32
Data IN 4	1	29	P/J5 23
	1	30	26
Data IN 5	1	31	P/J5 16
	1	32	20
Data IN 6	1	33	P/J5 10
	1	34	13

PIN FUNCTION LIST FOR ADAPTER CABLE FROM IBM 2701 TO THE AIU:

FROM IBM 2701 CABLE
PART NO. 5714301 (AIU END)

	Connector	Pin	TO AIU	
Data IN 7	1	37	P/J5	2
	1	38		5
Data IN 8	1	39	P/J5	73
	1	40		76
Data OUT 9	2	1	P/J4	1
	2	2		4
Data OUT 10	2	3	P/J4	8
	2	4		12
Data OUT 11	2	7	P/J4	15
	2	8		18
Data OUT 12	2	9	P/J4	22
	2	10		25
Data OUT 13	2	11	P/J4	28
	2	12		31
Data OUT 14	2	13	P/J4	34
	2	14		37
Data OUT 15	2	17	P/J4	40
	2	18		43
Data OUT 16	2	19	P/J4	46
	2	20		49
Data IN 9	2	21	P/J5	65
	2	22		70
Data IN 10	2	23	P/J5	58
	2	24		62
Data IN 11	2	27	P/J5	52
	2	28		55
Data IN 12	2	29	P/J5	46
	2	30		49

PIN FUNCTION LIST FOR ADAPTER CABLE FROM IBM 2701 TO THE AIU:

FROM IBM 2701 CABLE
PART NO. 5714301 (AIU END)

	Connector	Pin	TO AIU
Data IN 13	2	31	P/J5 40
	2	32	43
Data IN 14	2	33	P/J5 34
	2	34	37
Data IN 15	2	37	P/J5 28
	2	38	31
Data IN 16	2	39	P/J5 22
	2	40	25

4.2 DETAILED WIRE LISTING FOR THE GRE INTERFACE CARD (VIPS-022-4)

Detail Wire Listing for the GRE Interface Card

AA50 - AC50
AC50 - AE50
AE50 - AG50
AG50 - AJ50
AJ50 - BB50
BB50 - BD50
BD50 - BF50 -5 Dist.
BF50 - BH50
BH50 - CA50
CA50 - CC50
CC50 - CE50
CE50 - CG50
CG50 - EG50
EG50 - FF50

+Vcc - AA42
+Vcc - AC42
+Vcc - AE42
+Vcc - AG42
+Vcc - AJ42
+Vcc - BB42
+Vcc - BD42
+Vcc - BE42
+Vcc - BH42
+Vcc - CA42
+Vcc - CC42
+Vcc - CE42
+Vcc - CG42
+Vcc - EJ25
+Vcc - FB25

+Vcc - CJ42
+Vcc - DB42
+Vcc - DD42
+Vcc - DF42
+Vcc - DH42
+Vcc - EA42
+Vcc - EC42
+Vcc - EE42
+Vcc - EG42
+Vcc - EJ42
+Vcc - FB42
+Vcc - FD42
+Vcc - FF42
+Vcc - DD15
+Vcc - DF15

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Detail Wire Listing for the GRE Interface Card (Continued)

+Vcc - AA17
+Vcc - AC18
+Vcc - AE18
+Vcc - AG18
+Vcc - AJ17
+Vcc - BB17
+Vcc - BD17
+Vcc - BE17
+Vcc - BH17
+Vcc - CA17
+Vcc - CC17
+Vcc - CE26
+Vcc - CE8
+Vcc - CJ8
+Vcc - DB8
+Vcc - DD8
+Vcc - DF8
+Vcc - CJ26
+Vcc - DB26
+Vcc - DD26
+Vcc - DF26
+Vcc - DH26
+Vcc - EA26
+Vcc - EC26
+Vcc - EE25
+Vcc - EG26
+Vcc - FJ26
+Vcc - FB26
+Vcc - FD26

GND - AB50
GND - AD50
GND - AF50
GND - AH50
GND - BA50
GND - BC50
GND - BE50
GND - BG50
GND - BJ50
GND - CB50
GND - CD50
GND - CF50
GND - CH50
GND - EH50
GND - FG50
GND - AB42
GND - AD42
GND - AF42
GND - AH42
GND - BA42
GND - BC42
GND - BE42
GND - BG42
GND - BJ42
GND - CB42
GND - CD42
GND - CF42
GND - CH42
GND - DA42

GND - DC42
GND - DE42
GND - DG42
GND - DJ42
GND - EB42
GND - ED42
GND - EF42
GND - EH42
GND - FA42
GND - FC42
GND - FE42
GND - FG42
GND - CF26
GND - DA26
GND - DC26
GND - DE26
GND - DG26
GND - DJ26
GND - EB26
GND - ED26
GND - EF25
GND - EH25
GND - FA26
GND - FC26
GND - FE26
GND - AB17
GND - AD18
GND - AF18
GND - AH18

GND - BA17
GND - BC17
GND - BE17
GND - BG17
GND - BJ17
GND - CB17
GND - CD17
GND - CF8
GND - DA8
GND - DC8
GND - DE8
GND - DG8
GND - FA19
GND - FC19
GND - DE9
GND - DG9

Detail Wire Listing for the GRE Interface Card (Continued)

AA42 - AA49
AC42 - AC49
AE42 - AE49
AG42 - AG49
AJ42 - AJ49
BB42 - BB49
BD42 - BD49
BF42 - BF49
BH42 - BH49
CA42 - CA49
CC42 - CC49
CE42 - CE49
CG42 - CG49
EG42 - EG49
FF42 - FF49
AA42 - AA41
AC42 - AC41
AE42 - AE41
AG42 - AG41
AJ42 - AJ41
BB42 - BB41
BD42 - BD41
BF42 - BF41
BH42 - BH41
CA42 - CA41
CC42 - CC41
CE42 - CE41
CJ42 - CJ41
DB42 - DB41
DD42 - DD41

DF42 - DF41
DH42 - DH41
EA42 - EA41
EC42 - EC41
EE42 - EE41
EG42 - EG41
EJ42 - EJ41
FB42 - FB41
FD42 - FD41
DB42 - DB49
DD42 - DD49
DF42 - DF49
DH42 - DH49
EA42 - EA49
EC42 - EC49
+Vcc - AC33
+Vcc - AE33
+Vcc - AG33
+Vcc - BD33
+Vcc - BF33
+Vcc - CC33
+Vcc - CE33
+Vcc - CJ33
+Vcc - DB33
+Vcc - DD33
+Vcc - DF33
+Vcc - DH33
+Vcc - EA33
+Vcc - EC33
+Vcc - EG33

+Vcc - EJ33
+Vcc - FB33
+Vcc - AA24
+Vcc - AC25
+Vcc - AE25
+Vcc - AG25
+Vcc - AJ25
+Vcc - CE25
+Vcc - CJ25
+Vcc - DB25
+Vcc - DD25
+Vcc - DH25
+Vcc - EA25
+Vcc - EE24
+Vcc - EG25
+Vcc - AA16
+Vcc - AC17
+Vcc - AE17
+Vcc - AG17
+Vcc - BA12
+Vcc - BC12
+Vcc - BE12
+Vcc - BG12
+Vcc - BJ12
+Vcc - CB12
+Vcc - CD12
+Vcc - CE17
+Vcc - DH17
+Vcc - EC16
+Vcc - EE16

+Vcc - AA8
+Vcc - AC9
+Vcc - AE9
+Vcc - CA7
+Vcc - CC7
+Vcc - CE7
+Vcc - CJ7
+Vcc - DB7
+Vcc - DD7
+Vcc - DF7

Detail Wire Listing for the GRE Interface Card (Continued)

GND - AB43
GND - AD43
GND - AF43
GND - AH43
GND - BA43
GND - BC43
GND - BE43
GND - BG43
GND - BJ43
GND - CB43
GND - CD43
GND - CF43
GND - CH43
GND - DC43
GND - DE43
GND - DG43
GND - DJ43
GND - EB43
GND - ED43
GND - EH43
GND - FG43
DB43 - DC43
DD43 - DE43
DF43 - DG43
DH43 - DJ43
EA43 - EB43
EC43 - ED43
GND - AB35
GND - AD35
GND - AF35
GND - AH35
GND - BA35
GND - BC35
GND - BE35
GND - BG35
GND - BJ35
GND - CB35
GND - CD35
GND - CF35
GND - DA35
GND - DC35
GND - DE35
GND - DG35
GND - DJ35
GND - EB35
GND - ED35
GND - EF35
GND - EH35
GND - FA35
GND - FC35
GND - FE35
GND - AD27
GND - AF27
GND - AH27
GND - BE27
GND - BG27
GND - CD27
GND - CF27
GND - DA27
GND - DC27
GND - DE27
GND - DG27
GND - DJ27
GND - EB27
GND - ED27
GND - EH27
GND - FA27
GND - FC27
GND - AB18
GND - AD19
GND - AF19
GND - AH19
GND - BA19
GND - CF19
GND - DA19
GND - DC19
GND - DE19
GND - DJ19
GND - EB19
GND - EF18
GND - EH19
GND - AB10
GND - AD11
GND - AF11
GND - AH11
GND - AJ12
GND - BB12
GND - BD12
GND - BF12
GND - BH12
GND - CA12
GND - CC12
GND - CF11
GND - DJ11
GND - ED10
GND - EF10
GND - AB2
GND - AD3
GND - AF3
GND - CB1
GND - CD1
GND - CF1
GND - DA1
GND - DC1
GND - DE1
GND - DG1

Detail Wire Listing for the GRE Interface Card (Continued)

AH12 - BF13
BG13 - BH13
AH12 - CA13
CB13 - CC13
AG11 - AE29
AG11 - AF30
AE32 - AD37
AG11 - AB38
AD39 - AD38
AF39 - AF38
AH39 - AH38
BA39 - BA38
BC39 - BC38
AG13 - BE38
BE39 - BG39
BG38 - BJ39
BJ38 - CB39
CB38 - CD39
+Vcc - CG27
CG28 - CG29
CG30 - CG31
CG32 - CG33
CH27 - CE37
CC37 - CA37
BH37 - BF37
BD37 - BB37
BF13 - BG13
BH13 - BJ13
CA13 - CB13
CC13 - CD13

AF30 - AE32
AB38 - AD39
AD38 - AF39
AF38 - AH39
AH38 - BA39
BA38 - BC39
BE38 - BE39
BG39 - BG38
BJ39 - BJ38
CB39 - CB38
CD39 - CD38
CG27 - CG28
+Vcc - CG30
CG31 - CG32
CE37 - CC37
CA37 - BH37
BF37 - BD37
BB37 - AJ37
AJ37 - AG37
AE37 - AC37
AA2 - AB39
AG37 - AE37
AC37 - AA37
AB39 - CF39
GND - CF38
GND - AG43
CH28 - CH44
CF44 - CD44
CB44 - BJ44
BG44 - BE44

BC44 - BA44
AH44 - AF44
AD44 - AB44
CH44 - CF44
CD44 - CB44
BJ44 - BG44
BE44 - BC44
BA44 - AA44
AF44 - AD44
AB36 - AB37
AD36 - AD37
AF36 - AF37
AH36 - AH37
BA36 - BA37
BC36 - BC37
BE36 - BE37
BG36 - BG37
BJ36 - BJ37
CB36 - CB37
CD36 - CD37
CF36 - CF37
AB40 - AB41
AD40 - AD41
AF40 - AF41
AH40 - AH41
BA40 - BA41
BC40 - BC41
BE40 - BE41
BG40 - BG41
BJ40 - BJ41

CB40 - CB41
CD40 - CD41
CF40 - CF41
CH44 - EH44

CB45 - CA43
BJ45 - BH43
BG45 - BF43
BE45 - BD43
BC45 - BB43
CH29 - CH45
CG43 - CF45
CE43 - BA45
AJ43 - AH45
AE43 - AD45
AC43 - AB45
CH30 - EG43
FF43 - FG45
CH30 - DC49
DC49 - DG49
DJ49 - EB49
GND - DE48
DB47 - DB46
DD47 - EH37
EH36 - DD46
DF47 - DF46
DH47 - DH46
EA47 - EA46
EC47 - EC46
EH44 - FG44

Detail Wire Listing for the GRE Interface Card (Continued)

EC41 - EE28
EC33 - EE30
AG25 - BF18
AE17 - BF20
AJ25 - BF22
CC33 - BF24
CA7 - CG1
CC7 - CG3
CE7 - CG5
CJ7 - CG7
DB7 - DH1
DD7 - DH3
DF7 - DH5
EC38 - EF28
EC30 - EF30
AG22 - BG18
AE14 - BG20
AJ22 - BG22
CC30 - BG24
CA4 - CH1
CC4 - CH3
CE4 - CH5
CJ4 - CH7
DB4 - DJ1
DD4 - DJ3
DF4 - DJ5
EC37 - EF29
EC29 - EF31
AG21 - BG19
AE13 - BG21
AJ21 - BG23
CC29 - BG25
CA3 - CH2
CC3 - CH4
CE3 - CH6
CJ3 - CH8
DB3 - DJ2
DD3 - DJ4
DF3 - DJ6
AB46 - CB3
CB3 - CD3
CD3 - DA3
DA3 - DE3
CD7 - CF3
DA7 - DC3
DE7 - DG3
AB46 - AC12
AH21 - AA7
AA44 - AD8
AD8 - AB6
CB1 - CB4
CD1 - CD4
CF1 - CF4
DA1 - DA4
DC1 - DC4
DE1 - DE4
DG1 - DG4
AH19 - AH22
AF11 - AF14
BA19 - BA22
CD27 - CD30
ED35 - ED38
ED27 - ED30
CB4 - CB5
CD4 - CD5
CF4 - CF5
DA4 - DA5
DC4 - DC5
DE4 - DE5
DG4 - DG5
AH22 - AH23
AF14 - AF15
BA22 - BA23
CD30 - CD31
ED38 - ED39
ED30 - ED31

Detail Wire Listing for the GRE Interface Card (Continued)

CD45 - CB45
CA43 - BJ45
BH43 - BG45
BF43 - BE45
BD43 - BC45
CH45 - CG43
CF45 - CE43
BA45 - AJ43
AH45 - AF45
AF45 - AE43
AD45 - AC43
AB45 - AA43
EG43 - EH45
EH45 - FG45
FG46 - DE49
DG49 - DJ49
EB49 - ED49
DC47 - DC46
DE47 - DE46
DG47 - DG46
DJ47 - DJ46
EB47 - EB46
ED47 - ED46

Detail Wire Listing for the GRE Interface Card (Continued)

AD46 - AB24
AC44 - AB22
AF46 - AB20
AE44 - AA19
AH46 - AA21
AD46 - AA26
AC44 - AB27
AF46 - AA29
AE44 - AB30
AH46 - AA32
AB26 - AB11
AA28 - AB12
AB29 - AB13
AA31 - AB14
AB32 - AB15
AB16 - CH30
AA13 - AB16
AA14 - AA13
AA10 - AA23
AA22 - AB5
AB23 - AA27
AB21 - AB28
AB19 - AA30
AA18 - AB31
AA20 - AA33

AD46 - AC27
AC44 - AC28
AF46 - AC29
AE44 - AC30
AH46 - AC31
BC46 - AC32
BB44 - AD32
BE46 - AD33
BD44 - AC19
BG46 - AC20
BF44 - AC21
BJ46 - AC22
BH44 - AC23
CB46 - AC24
CA44 - AD24
CD46 - AD25
AJ44 - CE28
CE27 - AD31
AJ44 - AD30
AD29 - AD23
AD28 - AD22
AD20 - AD16
AD16 - AD5

AF41 - BD27
AF37 - BD28
AH41 - BD29
AH37 - BD30
BA41 - BD31
BA37 - BD32
BC41 - BE32
BC37 - BE33
BE41 - BF27
BE37 - BF28
BG41 - BF29
BG37 - BF30
BJ41 - BF31
BJ37 - BF32
CB41 - BG32
CB37 - BG33
CD41 - BG28
GND - BE31
CH30 - BE30
BE29 - BG31
BE28 - BG30

AH13 - AG12
AG12 - AG14
AE21 - AH13
AE3 - AE19
AD12 - AF33
AD12 - AE7
AF33 - CF16
AF4 - CF14
AF6 - CF13
CF12 - CF24
AC3 - CF23
CF25 - CF33
CF32 - CF41
CG44 - CF21
CF22 - CF31
FC23 - GND
FC24 - DE3
ED21 - FC22
EH17 - FC25
FC21 - CF20
DE36 - DD48
DD35 - DD48
FE44 - FG48
FE45 - FG49
CD45 - DE10
AH22 - DE11
CF22 - DE12
AF23 - AF24

Detail Wire Listing for the GRE Interface Card (Continued)

Out	In
AF41 - BF16	BG15 - FF44
AF37 - BF15	DE49 - BG14
AH41 - BF10	BG11 - EG44
AH37 - BF9	BG10 - EH46
BA41 - BH16	BJ15 - EB37
BA37 - BH15	BJ14 - ED18
BC41 - BH10	BJ11 - DC47
BC37 - BH9	BJ10 - GND
BE41 - CA16	CB15 - GND
BE37 - CA15	CB14 - GND
BG41 - CA10	CB11 - GND
BG37 - CA9	CB10 - DG18
BJ41 - CC16	CD15 - DF20
BJ37 - CC15	CD14 - DG21
CB41 - CC10	CD11 - DF23
CB37 - CC9	CD10 - DG24

+Vcc - EC18
+Vcc - EC25

Detail Wire Listing for the GRE Interface Card (Continued)

CH32 - DF18
DF18 - DG19
DG19 - DF21
DF21 - DG22
DG22 - DF24
GND - DF19
GND - DG20
GND - DF22
GND - DG23
GND - DF25
BG15 - DC28
BG14 - DC29
BG11 - DC30
BG10 - DC31
BJ15 - DC32
BJ14 - DC33
BE30 - DB30
DB30 - DB31
DG31 - AG32
AG31 - DG30
CE44 - AF5
AF5 - CF17
CF17 - CF29
CF28 - DG29
DG28 - CJ38
CJ37 - CJ31
CH46 - CJ29
CJ27 - AE20
CJ27 - CD29

CD28 - CD37
DB30 - DA30
DA30 - DA31
DA31 - CJ30
GND - CJ28
GND - DA29
AA50 - AA48
AC50 - AC48
AE50 - AE48
AG50 - AG48
AJ50 - AJ48
BB50 - BB48
BD50 - BD48
BF50 - BF48
BH50 - BH48
CA50 - CA48
CC50 - CC48
CE50 - CE48
CG50 - CG48
EG50 - EG48
FF50 - FF48
AA48 - AA38
AC48 - AC38
AE48 - AE38
AG48 - AG38
AJ48 - AJ38
BB48 - BB38
BD48 - BD38
BF48 - BF38
BH48 - BH38
CA48 - CA38
CC48 - CC38
CE48 - CE38

BC46 - AF6
BB44 - AF32
BE46 - BA11
BD44 - BA10
BG46 - BC15
BF44 - BC14
BJ46 - BC11
BH44 - BC10
CB46 - BE15
CA44 - BE14
CD46 - BE11
GND - BE10
AF31 - AH33
AH32 - AF24
AF25 - AH17
AH16 - AJ13
AJ13 - BA13
BA13 - BB13
BB13 - BC13
BC13 - BD13
BD13 - BE13
BB16 - EG31
BB15 - DE32
BB10 - DJ24
BB9 - EB40
BD16 - ED15
CF22 - DG15
DG15 - DG11
DG11 - DF11
DF11 - DF13
DF13 - DE14

Detail Listing for the GRE Interface Card (Continued)

AC7 - DC2
AA2 - AD6
AD6 - AD17
AC7 - AD14
AD7 - CH31
GND - AC4
AC4 - AC5
AC5 - AC6
AA6 - CF2
AB7 - AH25
AB2 - AB4
GND - AA3
AA3 - AA4
AA4 - AA5
AA2 - AC13
BA46 - AC15
CF46 - AH15
AH14 - AF29
AF28 - AH31
AH30 - AB37
AD6 - AF6
GND - AE4
AE4 - AE5
AE5 - AE6
AF12 - AB41
AF13 - AC11
DG2 - EG30
EG30 - DE31
DE31 - DJ23
DJ23 - EB39
EB39 - ED14
EG28 - FC39
EG27 - FB38
EG27 - FA41
EG27 - FD40
FC31 - EG32
FC28 - EG29
DA22 - FB39
DA22 - FC33
FC33 - FC29
FB35 - FC32
FC36 - FC30
EH28 - DA23
EH29 - FC38
FC38 - FB37
FC35 - FC37
GND - FB36
AD6 - FB40
FB40 - FC40
ED20 - EH33
EJ39 - FE40
FD35 - DJ14
FE36 - DB48
FC40 - EH32
EH32 - FE39
CE39 - FE38
GND - FE37
GND - FD38
GND - FD37
GND - FD36
GND - FD39
GND - EH31
EH46 - EH41
EH46 - DJ17
EH40 - EJ40
EG44 - EH39
EG44 - DJ16
EH38 - FA40
FG46 - DJ13

Detail Wire Listing for the GRE Interface Card (Continued)

DF29 - EH23
DE28 - DD40
DE28 - EG22
EG22 - DE28
DJ17 - FA29
FA28 - DF29
DF27 - DE40
DE36 - DD48

DD28 - EG21
EG21 - EH22
DJ16 - EJ28
EJ27 - DF48
DD27 - FA33
FA32 - EG23
EG23 - DE25
DE25 - DE21
EG19 - DE24
EH20 - DE22
DE23 - DE33
DE20 - DE30
CH31 - DD31
GND - DD30
DE39 - DD31
DE38 - DE39
DE37 - GND

GND - DD36
DD36 - DD37
DD37 - DD38
DD38 - DD39
DE39 - EG24
EG24 - EH24
GND - EG20
GND - EH21
EH41 - DH48
DJ21 - DH16
DJ21 - DJ39
DJ21 - DJ32
DJ20 - DH38
EH39 - DH15
FG46 - DH12
DH12 - DH13
DH11 - DH32
DJ28 - DG48

DH20 - DJ38
DJ38 - DH37
DH19 - EJ30
EJ29 - DH39
DH39 - DD20
DD20 - DD24
DH35 - DD21

DJ36 - DD23
DD19 - DJ25
DD22 - DJ22
DE39 - DH23
GND - DH22
DH23 - DJ30
DJ30 - DJ31
GND - DH28
DH28 - DH29
DH29 - DH30
DH30 - DH31
DJ31 - DH40
DH40 - DJ40
GND - DJ37
GND - DH36
EB37 - EF14
EF13 - DJ48
EB37 - EB31
EB36 - EF12
EF11 - EA48
EB36 - EA30
EB36 - EB48

ED19 - EA40
EA36 - EB30
EB30 - EA29
EA35 - CJ20

EJ19 - EA31
CJ19 - DG41
DG41 - DG37
EB28 - DG38
EA27 - DG40
DG39 - EB41
DG36 - EB38
DJ40 - EA39
GND - EA38
GND - EB29
GND - EA28
EA39 - EA32
EA32 - EB32
ED12 - ED37
ED12 - EF39
ED11 - ED29
ED11 - EE38
ED41 - ED48
ED33 - EC48

EC11 - EF38
EF38 - EE37
EC10 - EE11
EE10 - EE39
EE10 - DF36
DF36 - DF40

Detail Wire Listing for the GRE Interface Card (Continued)

EE35 - DF37
EF36 - DF39
DF35 - ED16
DF38 - ED13
EB32 - EC14
EC13 - GND
GND - EF37
GND - EE36
DJ12 - DC48
EH40 - DH48

Detail Wire Listing for the GRE Interface Card (Continued)

31 - AB49
92 - AB48

32 - AA47
93 - AA46

50 - AD49
111 - AD48

51 - AC47
112 - AC46

52 - AF49
113 - AF48

53 - AE47
114 - AE46

54 - AH49
115 - AH48

38 - AA40
99 - AA39

37 - BA49
98 - BA48

34 - AJ47
95 - AJ46

39 - BC49
100 - BC48

40 - BB47
101 - BB46

41 - BE49
102 - BE48

42 - BD47
103 - BD46

43 - BG49
104 - BG48

44 - BF47
105 - BF46

45 - BJ49
106 - BJ48

46 - BH47
107 - BH46

47 - CB49
108 - CB48

48 - CA47
109 - CA46

49 - CD49
110 - CD48

33 - CF49
64 - CF48

1 - AA35
62 - AA36

7 - AC40
68 - AC39

2 - AC35
63 - AC36

2 - CE47
63 - CE46

10 - AE40
71 - AE39

11 - AE35
72 - AE36

12 - AG40
73 - AG39

13 - AG35
24 - AG36

14 - AJ40
25 - AJ39

15 - AJ35
76 - AJ36

16 - BB40
77 - BB39

47 - BB35
78 - BB36

18 - BD40
79 - BD39

19 - BD35
80 - BD36

20 - BF40
81 - BF39

21 - BF35
82 - BF36

22 - BH40
83 - BH39

23 - BH35
84 - BH36

24 - CA40
85 - CA39

25 - CA35
86 - CA36

9 - CC40
70 - CC30

57 - CC35
118 - CC36

57 - CH49
118 - CH48

35 - CE40
96 - CE39

29 - CB47
90 - CG46

59 - +Vcc
GND - 120

GND - 121
60 - AA50

120 - 121
60 - FF50

8 - CC47
69 - CC46

1 - DB45
62 - +Vcc

2 - EH49
63 - EH48

3 - EG47
64 - EG46

22 - ED20
83 - EH12

5 - DC45
66 - DC44

6 - FD46
67 - FD45

7 - EH17
68 - ED21

23 - FF37
84 - FF38

8 - +Vcc
69 - DD45

9 - ED22
70 - EH13

10 - +Vcc
71 - DF45

11 - +Vcc
72 - DG45

12 - ED23
73 - EH14

13 - +Vcc
74 - DH45

14 - EH10
75 - DJ45

15 - EH11
76 - EA45

16 - ED19
77 - EH15

17 - +Vcc
78 - EB45

18 - +Vcc
79 - ED45

19 - +Vcc
80 - EC45

20 - ED24
81 - EH16

21 - ED18
82 - GND

Detail Wire Listing for the GRE Interface Card (Continued)

ED18 - DF32
DF31 - EF24
DF30 - EF16
EF15 - EF22
DF18 - EF23
EF20 - DG32
DB27 - DG33
EH12 - EH30
DD32 - ED22
EH13 - DD29
DH24 - ED23
EH14 - DH21
EH15 - EA37
EH16 - EC12
EC15 - ED24
+Vcc - EG16
90 - GND
AC16 - AC13
AD17 - AD13

Detail Wire Listing for the GRE Interface Card (Continued)

AG11 - BA32
AG11 - AF30
BA32 - AD37
CC44 - AF21
AH20 - AF20
AF22 - AF8
AF22 - BA33
AF8 - DA32
BA29 - AD41
CF46 - BA31
+Vcc - EG10
+Vcc - EG11
BJ11 - DC47
DJ12 - DC48

FG36 - FF47
FG37 - FF46
DB30 - CC43
+Vcc - AJ33
GND - BA27
DB44 - GND
DD44 - GND
DF44 - GND
DG44 - GND
DH44 - GND
DJ44 - GND
EA44 - GND
EB44 - GND
ED44 - GND
EC44 - GND
AH22 - AD8

Bottom Row	Top Row
1 - AB46	1 - AB37
2 - AA44	2 - AD37
3 - --	3 - CF46
4 - BA46	4 - AD41
5 - AB41	5 -
6 - CF41	6 -
7 - AJ44	7 - CD41
8 - AD46	8 - AF41
9 - AC44	9 - AF37
10 - AF46	10 - AH41
11 - AE44	11 - AH37
12 - AH46	12 - BA41
13 - BC46	13 - BA37
14 - BB44	14 - BC41
15 - BE46	15 - BC37
16 - BD44	16 - BE41
17 - BG46	17 - BE37
18 - BF44	18 - BG41
19 - BJ46	19 - BG37
20 - BH44	20 - BJ41
21 - BC46	21 - BJ37
22 - CA44	22 - CB41
23 - CD46	28 - CB37

VIPS CHASSIS TO GRE CABL

P503 - P3
1 - F
4 - G
8 - H
12 - J
15 - K
18 - L
53 - M
56 - N
22 - P
25 - R
28 - S
31 - T
34 - u
37 - a
59 - V
63 - s
40 - g
43 - h
46 - e
49 - f
52 - j
55 - k
58 - m
62 - n
65 - p
70 - q
73 - r
76 - U
2 - v
5 - w
10 - y
13 - x
16 - z
20 - AA

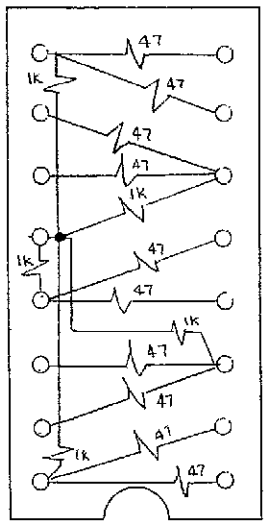
P503 - P3
23 - BB
26 - CC
29 - DD
32 - EE
35 - FF
38 - GG
41 - HH
44 - JJ
47 - KK
50 - LL
66 - A
71 - B
74 - C
77 - D
3 - W
7 - X
11 - Y
14 - Z
17 - b
21 - c
24 - MM
27 - NN

GRE CARD TO VIPS CHASSIS CABLE

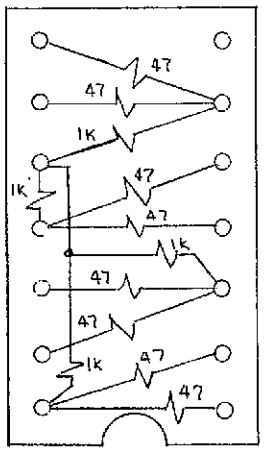
J203 - J503	J203 - J503
1 - 1	17 - 23
62 - 4	78 - 26
2 - 8	18 - 29
63 - 12	79 - 32
3 - 15	19 - 35
64 - 18	80 - 38
22 - 53	20 - 41
83 - 56	81 - 44
5 - 22	21 - 47
66 - 25	82 - 50
6 - 28	24 - 66
67 - 31	85 - 71
7 - 34	25 - 74
68 - 37	86 - 77
23 - 59	26 - 3
84 - 63	87 - 7
8 - 40	27 - 11
69 - 43	88 - 14
9 - 46	28 - 17
70 - 49	89 - 21
10 - 52	29 - 27
71 - 55	90 - 24
11 - 58	30 - 30
72 - 62	91 - 33
12 - 65	31 - 36
73 - 70	92 - 39
13 - 73	
74 - 76	
14 - 2	
75 - 5	
15 - 10	
76 - 13	
16 - 16	
77 - 20	

FOLDOUT FRAME 1

FOLDOUT FRAME 2



SR1
SR2
SR3
SR4



SR5

THE BOEING COMPANY
DISCRETE COMPONENT MODULE - IBM 2701 REC. VIPS-021-5B

INTEGRATED CIRCUIT LISTING FOR IBM 2701 INTERFACE CARD

REF. DESIGNATOR	DEVICE	DESCRIPTION
Z1 - Z4	SN 74180N	Parity Generator
Z5 - Z22	SN 74121N	One-Shot Multivibrator
Z23 - Z24	SN 7470N	J-K Multivibrator
Z25 - Z27, Z68	SN 7474N	Dual D Multivibrator
Z28 - Z34	SN 54H87N	4 Bit True/Complement
Z35 - Z40	SN 7475N	Quad Latch
Z41 - Z43	SN 7493N	4 Bit Binary Counter
Z44 - Z45	SN 7483N	4 Bit Binary Adder
Z46 - Z48	SN 7430N	8 Input NAND
Z49 - Z52	SN 74H21N	Dual 4 Input AND
Z53 - Z55, Z67	SN 74H11N	Triple 3 Input AND
Z56 - Z60, Z66 Z65 - Z73	SN 7404N	Hex Inverter
Z61	SN 7420N	Dual 4 Input NAND
Z62 - Z63	SN 7402N	Quad 2 Input NOR
Z64 - Z65	SN 7407N	Hex Driver
Z66	SN 7408N	Quad 2 Input AND
D1 - D18	SN 75450N	Dual Peripheral Driver
D19 - D41	SN 75109N	Line Driver
R1 - R36	SN 75107N	Line Receiver

INTEGRATED CIRCUIT LISTING FOR THE GRE INTERFACE CARD

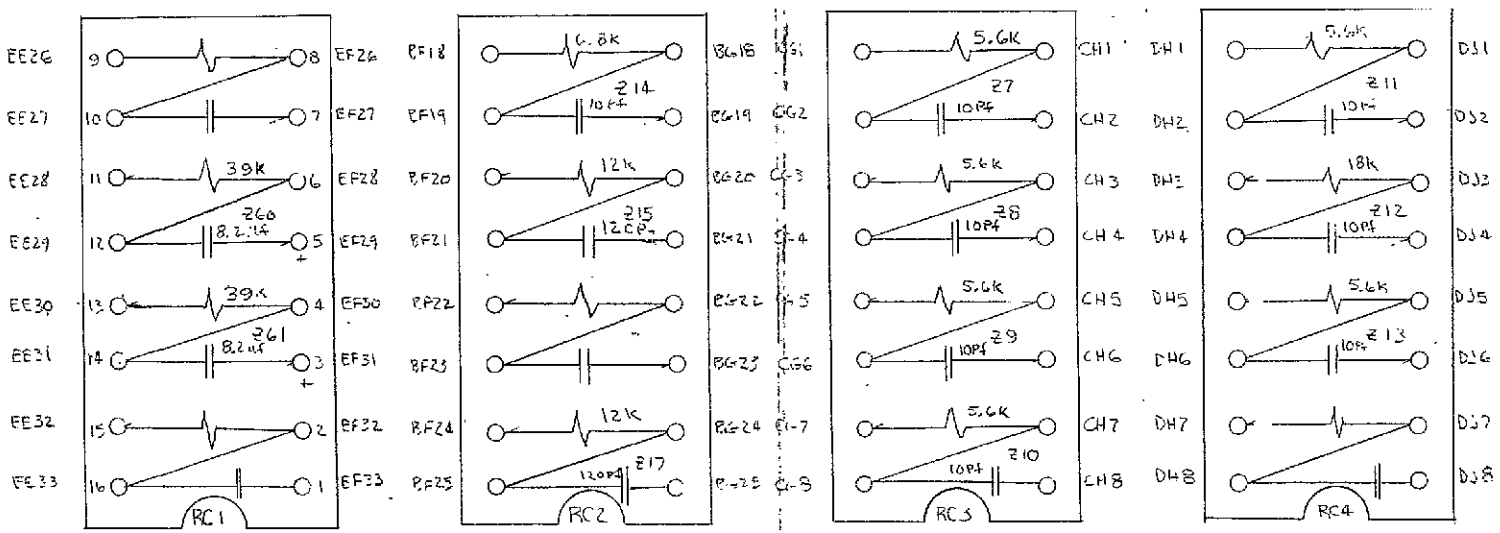
REF. DESIGNATOR	DEVICE	DESCRIPTION
D1 - D12	SN 75109N	Line Driver
D20 - D25	SN 75450N	Dual Peripheral Driver
R1 - R13, R20, R21	SN 75107N	Line Receiver
Z1, Z2	------	GRE Address Module
Z3 - Z6	SN 74180N	Parity Gen/Chkr
Z7 - Z17	SN 74121N	One-Shot MV
Z18 - Z21	SN 7470N	J-K MV
Z22 - Z28	SN 7475N	Quad Latch
Z29	SN 7404N	Hex Inverter
Z30, Z31	SN 7430N	8 Input Nand
Z32, Z33	SN 74H21N	Dual 4-Input And
Z34, Z35	SN 74H00N	Quad 2-Input Nand
Z36, Z37	SN 7402N	Quad 2-Input Nor
Z38, Z39	SN 7404N	Hex Inverter
Z40, Z41	SN 7470N	J-K MV
Z42	SN 7474N	Dual D MV
Z43	SN 7400N	Quad 2-Input Nand
Z44	SN 7440N	Dual 4-Input Nand
Z45	SN 7404N	Hex Inverter
Z46	SN 7410N	Tri 3-Input Nand
Z47	SN 7404N	Hex Inverter
Z48	SN 7474N	Dual D MV
Z49	SN 7470N	J-K MV
Z50	SN 7470N	Dual D MV
Z51	SN 7400N	Quad 2-Input Nand
Z52	SN 7474N	Dual D MV

INTEGRATED CIRCUIT LISTING FOR THE GRE INTERFACE CARD (Continued)

REF. DESIGNATOR	DEVICE	DESCRIPTION
Z53, Z54	SN 7470N	J-K MV
Z55	SN 7400N	Quad 2-Input Nand
Z56	SN 7474N	Dual D MV
Z57	SN 7404N	Hex Inverter
Z58	SN 7474N	Dual D MV
Z59	SN 7470N	J-K MV
Z60, Z61	SN 74121N	One-Shot MV
Z62	SN 7470N	J-K MV
Z63	SN 7474N	Dual D MV
Z67		-18VDC Receiver Module
Z68, Z69	SN 7404N	Hex Inverter
Z70, Z71	SN 7400N	Quad 2-Input Nand
Z72		Discrete Component Module
Z73		+18 VDC Receiver Module
RR1, RR2, RR3		Discrete Component Module
RC1, RC2, RC3		Timing RC Modules
Z64, Z78	SN 7474N	Dual D MV
Z74	SN 7404N	Hex Inverter
Z75, Z76	SN 7408N	Quad 2-Input Nand
Z77	SN 7402N	Quad 2-Input Nor

FOLDOUT FRAME 1

FOLDOUT FRAME 2



ENG - D J. HAAKENSON 1/8/71	THE BOEING COMPANY
	RC TIMING MODULES
	VIPS-022-5D

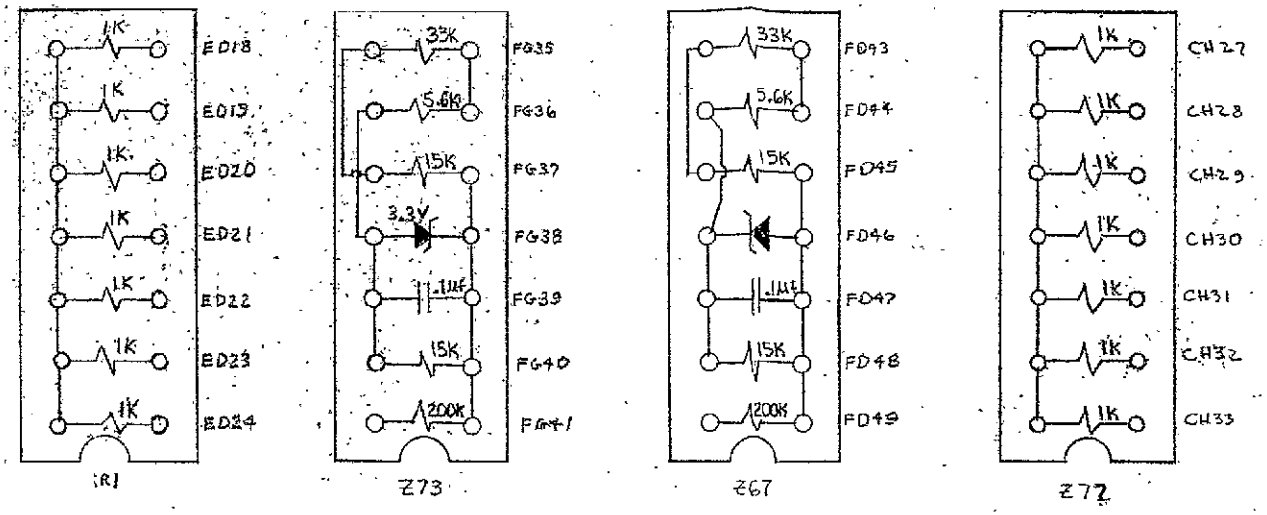
4 3 2 1

LTR	ZONE	REVISION	DATE	APPROVAL

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3



PART NUMBER	DESCRIPTION	MATERIAL	SPECIFICATION

SURFACE FINISH IN MICROINCHES RMS UNLESS NOTED OTHERWISE ✓

DIMENSIONAL TOLERANCE: UNLESS NOTED OTHERWISE
.0 ± .10
.00 ± .02
.000 ± .005
ANGULAR ±

NEXT ASSEMBLY

SIGNATURES	DATE
DR	
ENG D S Hathaway	12/11/70
CH	
APP	
AUTH	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

DISCRETE COMPONENT MODULES GRE INTERFACE

CODE IDENT NO.	SIZE	DWG NO.
	B	VIPS-022-5E
SCALE		SHEET 1

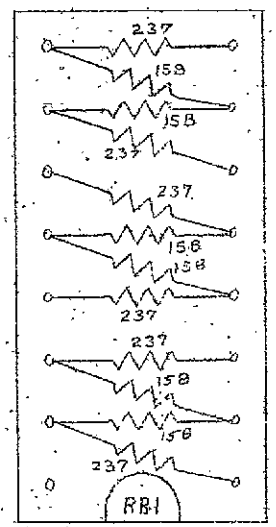
MSC Form 3616-R1 (REV OCT 65)

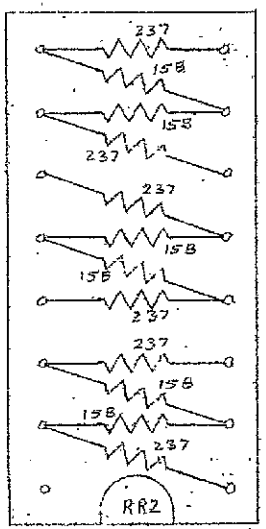
LTR	ZONE	REVISION	DATE	APPROVAL

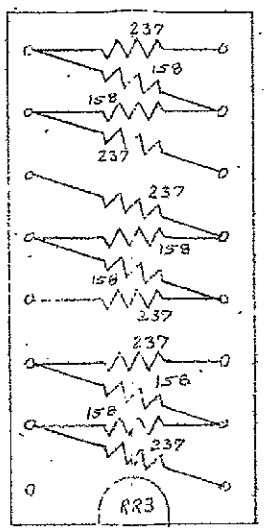
FOLDOUT FRAME 1

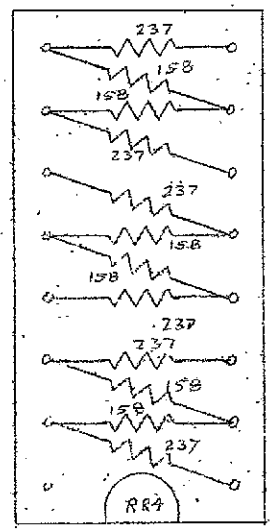
FOLDOUT FRAME 2 ⊕3

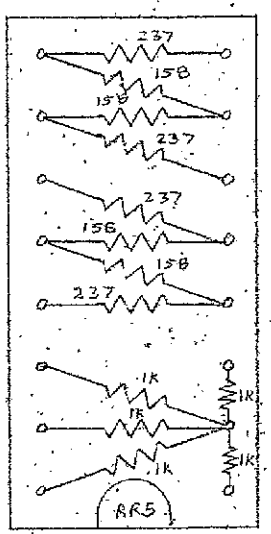
FOLDOUT FRAME 3











PART NUMBER	DESCRIPTION	MATERIAL	SPECIFICATION

SURFACE FINISH IN MICROINCHES RMS UNLESS NOTED OTHERWISE ✓	DIMENSIONAL TOLERANCE UNLESS NOTED OTHERWISE .0 ± .10 .00 ± .02 .000 ± .005 ANGULAR ±	SIGNATURES	DATE
		DR [illegible]	11/3/72
		ENG [illegible]	11/3/72
		CH [illegible]	3/31/71
		APP	
		AUTH	
	NEXT ASSEMBLY		

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

RESISTOR MODULES FOR 2701 DRIVERS

CODE IDENT NO.	SIZE	DWG NO.	SHEET
	B	VIPS-021-5D	

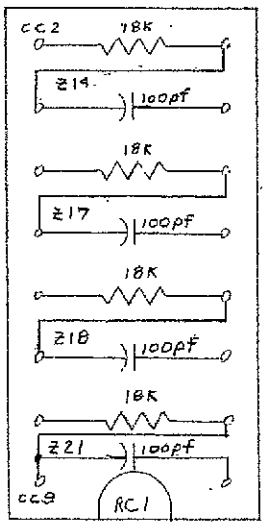
SCALE

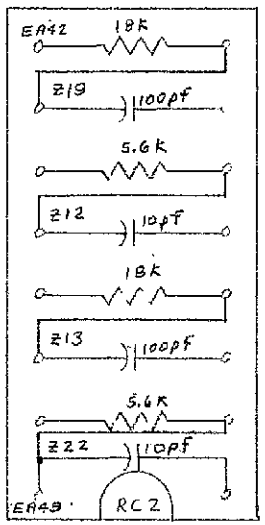
LTR	ZONE	REVISION	DATE	APPROVAL

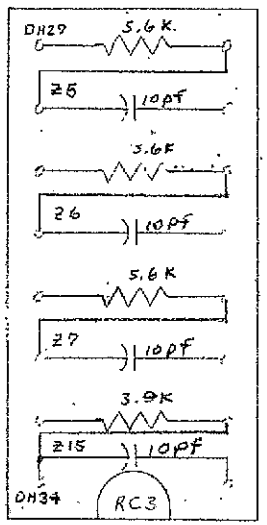
FOLDOUT FRAME 1

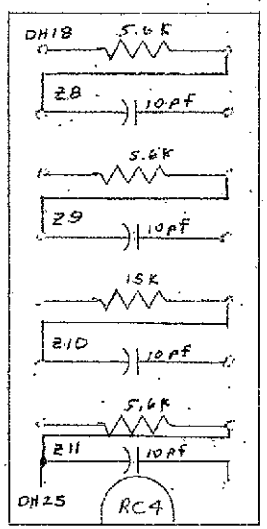
FOLDOUT FRAME 2

FOLDOUT FRAME 3









PART NUMBER	DESCRIPTION	MATERIAL	SPECIFICATION

SURFACE FINISH IN MICROINCHES RMS UNLESS NOTED OTHERWISE ✓

DIMENSIONAL TOLERANCE UNLESS NOTED OTHERWISE
.0 ± .10
.00 ± .02
.000 ± .005
ANGULAR ±

NEXT ASSEMBLY

SIGNATURES	DATE
DR R. M. L. Linton	11/13/70
ENG R. M. J. D. Hughes	11/13/70
CH O. H. Wakenson	3/31/71
APP	
AUTH	

NATIONAL AERONAUTICS AND SPACE ADMINISTRATION
MANNED SPACECRAFT CENTER · HOUSTON, TEXAS

RC TIMING MODULES

CODE IDENT NO.	SIZE	DWG NO.
	B	V1PS-021-5C

SCALE

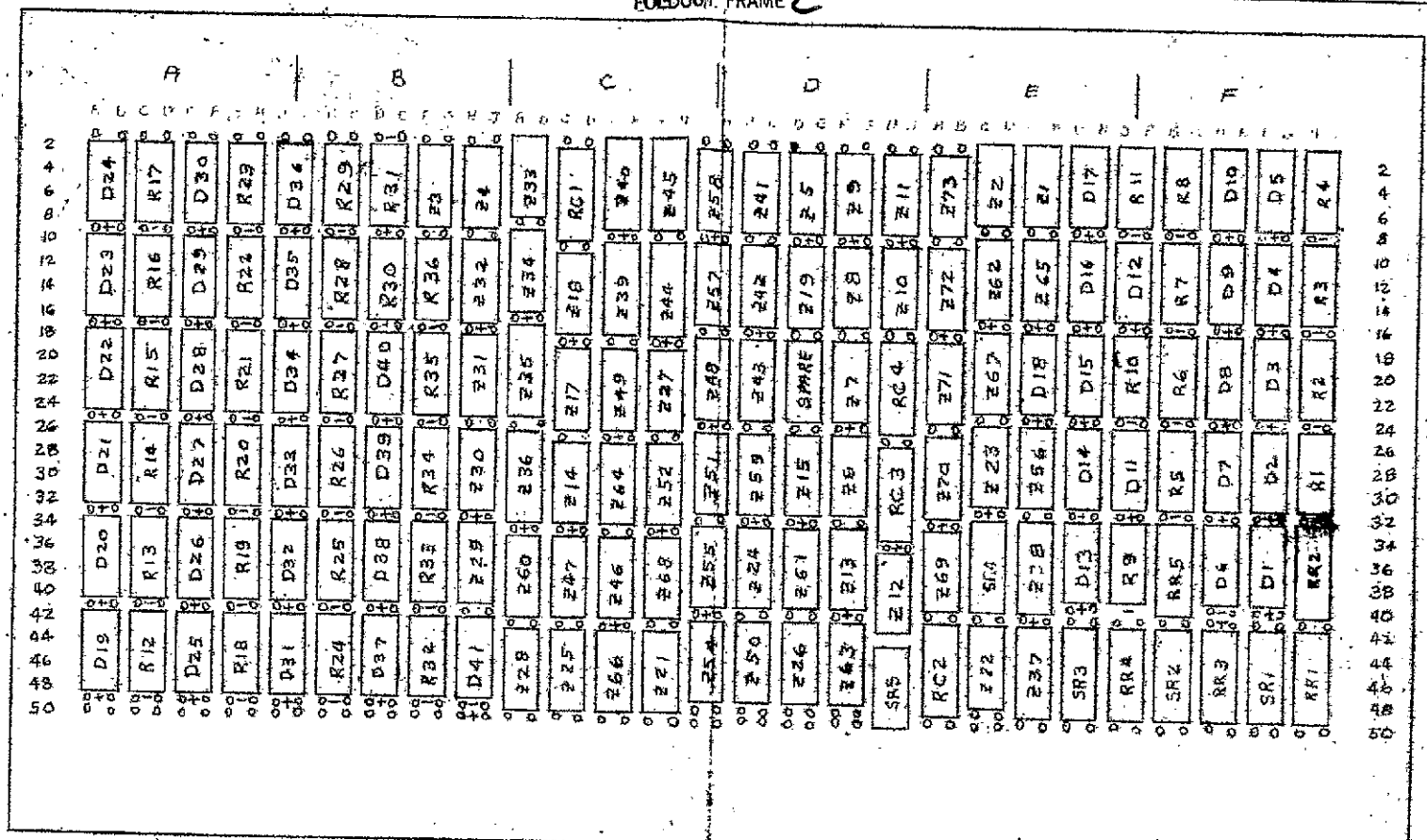
SHEET 1

FOLDOUT FRAME 1

FOLDOUT FRAME 2

FOLDOUT FRAME 3

LTR	ZONE	REVISION	DATE	APPROVAL



NOTES:

1. LOCATION OF POWER DISTRIBUTION DECOUPLING CAPACITORS ARE INDICATED BY +, −.

PART NUMBER	DESCRIPTION	MATERIAL	SPECIFICATION

SURFACE FINISH IN MICROINCHES RMS UNLESS NOTED OTHERWISE ✓

DIMENSIONAL TOLERANCE UNLESS NOTED OTHERWISE
.0 ± .10
.00 ± .02
.000 ± .005
ANGULAR ±

NEXT ASSEMBLY

SIGNATURES	DATE
DR	
ENG	
CH K.O. Van Knutsen	3/31/71
APP	
AUTH	

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MANNED SPACECRAFT CENTER • HOUSTON, TEXAS

IBM 2701 LOGIC MODULE LAYOUT

CODE IDENT NO.	SIZE	DWG NO.
	B	V[illegible] 2
SCALE		SHEET 1 OF 1

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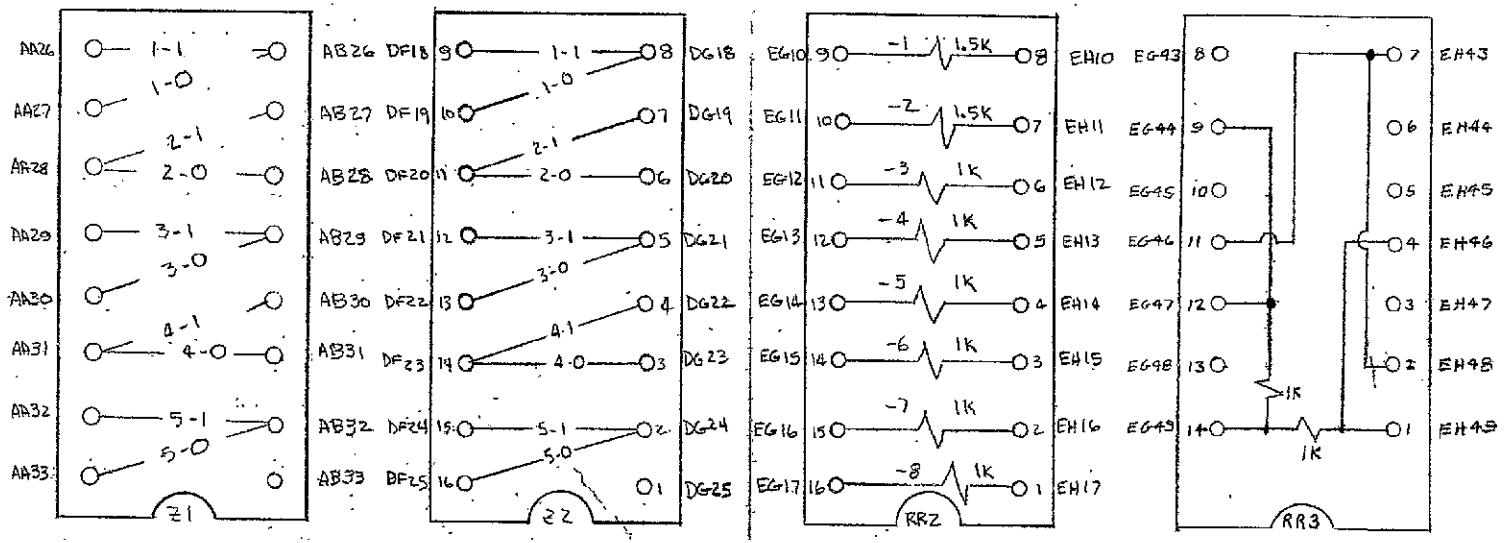
FOLDOUT [redacted] 1

FOLDOUT FRAME 2



THE BOEING COMPANY

DISCRETE COMPONENT MODULES

VIPS-022-58